pomor

MASTER PROGRAM

for applied polar and marine sciences

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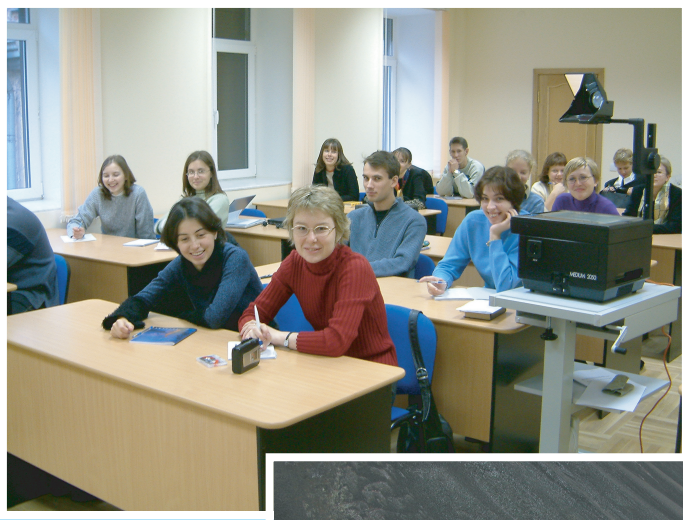

Neue Kenntnisse erwerben und ....

....in der Praxis anwenden

Wissenschaftskooperationen Länder übergreifend pflegen

DAAD- PROGRAMM: EXPORT DEUTSCHER STUDIENANGEBOTE - ABSCHLUSSBERICHT 2001-2004

Redaktionsteam:
Dr. Kirsten Tuschling, Dr. Heidemarie Kassens und Dr. Karen Volkmann-Lark
Stiftung Alfred-Wegener-Institut für Polar- und Meeresforschung und Leibniz-Institut für Meereswissenschaften

Kiel, den 21. Januar 2005

DAAD-Programm: Export deutscher Studienangebote

Abschlussbericht

Kooperative Fakultät für angewandte Polar- und Meereswissenschaften an der Staatlichen Universität St. Petersburg

Masterstudiengang POMOR

Förderzeitraum: 01.01.2001 bis 31.10.2004

Antragsteller: Prof. Dr. Gerold Wefer
Universität Bremen
Postfach 330440
28334 Bremen
gwefer@allgeo.uni-bremen.de

Prof. Dr. Jörn Thiede
Stiftung Alfred-Wegener-Institut für Polar- und Meeresforschung in der Helmholtz-Gemeinschaft
Postfach 12 01 61
27515 Bremerhaven
jthiede@awi-bremerhaven.de

INHALTSVERZEICHNIS

I. Einleitung und übergeordnete Zielsetzung

Die Einrichtung einer kooperativen Fakultät an der Staatlichen Universität St. Petersburg soll die Zusammenarbeit zwischen Russland und Deutschland im Bildungsbereich vertiefen und die Universitätsausbildung mit interdisziplinären Lehrveranstaltungen internationalisieren. Hierzu wurde zunächst der Masterstudiengang für angewandte Polar- und Meereswissenschaften konzipiert und realisiert. Übergeordnet wurde mit der Einrichtung des Masterstudienganges POMOR ein deutlicher Gewinn im Kultur- und Bildungsaustausch zwischen beiden Ländern erzielt. Die gemeinsame praxisorientierte Ausbildung von Studierenden in modernen angewandten Themenfeldern der Polar- und Meereswissenschaften auf hohem internationalen Niveau wurde durch das Projekt umgesetzt.

Das Ziel, Studierende gemeinsam auszubilden und das deutsch-russische Verhältnis im Bereich der Polar- und Meereswissenschaften zu intensivieren, sollte mit folgenden Aufgabenschwerpunkten erreicht werden:

- Entwicklung eines gemeinsamen Curriculums
- Planung und Durchführung des Unterrichts und der Praktika
- Anerkennung des Studiengangs in beiden Ländern und Qualitätssicherung
- Einrichtung der Unterrichtsräume
- Gemeinsame Öffentlichkeitsarbeit
- Entwicklung weiterer Projekte in der bilateralen Zusammenarbeit

II. Darstellung der erzielten Ergebnisse

Der Masterstudiengang POMOR hat sich aus erfolgreichen russisch-deutschen Kooperationsprojekten in der Polar- und Meeresforschung, wie z.B. dem Otto-Schmidt-Labor für Polar- und Meeresforschung (OSL) am Staatlichen Institut für Arktis- und Antarktisforschung in St. Petersburg, entwickelt. POMOR dient mit seinem Studienangebot dem effektiven Wissenstransfer auf die nächste Wissenschaftsgeneration und eröffnet russischen Wissenschaftlern Perspektiven im eigenen Land.

Die konkrete Planung und Umsetzung zur Einrichtung des Masterstudiengangs POMOR begann im August 2001. Zunächst fanden vertiefende Gespräche mit den russischen Kooperationspartnern über die Ausgestaltung des Studienganges und die Sondierung der formalen Erfordernisse zur Genehmigung des Studienganges in Russland statt. Zeitgleich

wurden an der Staatlichen Universität St. Petersburg Räumlichkeiten gesucht und mit dem Umbau und der Einrichtung der Unterrichtsräume begonnen. POMOR wird in einem breit angelegten Netzwerk aus Universitäten und Forschungseinrichtungen in Norddeutschland und Russland (Abbildung 1) realisiert.

Abb. 1: Organigramm des Masterstudiengangs POMOR.

Dies Netzwerk sichert zum einen die Bündelung der Fachkompetenz der beteiligten Institutionen in Norddeutschland und Russland, zum anderen etabliert es den wechselseitigen Technologie- und Wissenstransfer. Bereits vor Beginn dieses Vorhabens bestand ein Kooperationsvertrag zwischen der Staatlichen Universität St. Petersburg und der Universität Bremen. Für die gemeinsame Durchführung des Masterstudienganges POMOR wurde 2003 ein weiterer Kooperationsvertrag zwischen der Staatlichen Universität St. Petersburg und dem Verbund norddeutscher Universitäten geschlossen.

- Entwicklung eines gemeinsamen Curriculums

Der Masterstudiengang POMOR mit Schwerpunkten in den angewandten Polar- und Meereswissenschaften bildet Studierende aus der Russischen Föderation und anderen Nationen in einem viersemestrigen Studium praxisbezogen aus. Aufbauend auf den Disziplinen Ozeanographie, Meeresbiologie und marine Geowissenschaften werden neben

natur-, ingenieurs- und wirtschaftswissenschaftlichen Aspekten Kenntnisse in den Informations- und Kommunikationstechnologien vermittelt. Das vorwiegend englischsprachige Studium wird mit einem Master of Science in Applied Polar and Marine Sciences (s. Anhang) abgeschlossen.

Grundlage für den POMOR Masterstudiengang war der gerade an der Universität Bremen eingerichtete englischsprachige vier-semestrige Master-Studiengang "Environmental and Marine Geosciences". Studien- und Prüfungsordung wurden ins Russische übersetzt und den speziellen Anforderungen in St. Petersburg angepasst. Die enge Anlehnung an einen bereits bestehenden Studiengang machte es erst möglich, den POMOR-Studiengang durch den Senator für Bildung und Wissenschaft der Freien Hansestadt Bremen anerkannt zu bekommen, um ein Doppeldiplom ausstellen zu können.

Das Curriculum und die Rahmenbedingungen für das Studium wurden während mehrerer Arbeitstreffen in Russland und Deutschland erarbeitet. Neben vielen Treffen in kleinen Arbeitsgruppen wurden zwei längere Treffen abgehalten. An diesen Treffen nahmen Dozenten aller Module aus beiden Ländern teil. Während eines Workshops am Hanse Wissenschaftskolleg in Delmenhorst (13.-15.2.2002) wurde von den 20 teilnehmenden Wissenschaftlern das generelle Unterrichtskonzept erarbeitet und in Arbeitsgruppen mit der Feinabstimmung innerhalb der Module begonnen (Abbildung 2). Ein Workshop an der Universität Bremen (17.-18.7.2003) diente vor allem der Koordination der Masterarbeiten und der Prüfungen der Studierenden im Sommersemester 2004. Die Protokolle des Workshops 2003 findet sich im Anhang.

Ein abgeschlossenes naturwissenschaftliches Grundstudium (Bachelor, Vordiplom) und ausreichende Englischkenntnisse werden als Aufnahmekriterien bei den Studierenden vorausgesetzt. Das Studium ist in drei Unterrichtssemester und ein Abschlusssemester untergliedert. In jedem Unterrichtssemester werden zwei Fachmodule (à 12 Semesterwochenstunden) sowie ein Allgemeiner Block (z.B. Wissenschaftliche Präsentationstechniken und englischer und deutscher Sprachunterricht) erteilt. Unterrichtssprache ist Englisch und übergangsweise in einigen Fächer Russisch. Die Fachmodule werden von russisch-deutschen Wissenschaftlerteams betreut und gliedern sich wie folgt (vgl. auch Anhang):

Modul 1: Ocean basins, morphology and sediments

Modul 2: High seas and coastal water oceanography

Modul 3: Ecosystems: structure and functioning

Modul 4: Non-living resources

Modul 5: Coastal systems: processes and management

Modul 6: Polar systems

Die Abstimmung der Prüfungsmodalitäten und die Maßnahmen zur Qualitätssicherung werden im Kapitel “Qualitätssicherung und Anerkennung des Studiengangs in beiden Ländern“ beschrieben.

Abb. 2: Teilnehmer des Dozententreffens im Hanse Wissenschaftskolleg Delmenhorst, Februar 2002.

- Planung und Durchführung des Unterrichts und der Praktika

In jedem Semester unterrichten ca. 15 russische und 15 deutsche Kollegen bei POMOR (s. Anhang). Vor Beginn eines Semesters wurde zunächst der Stundenplan zwischen den Modulen und dem Zeitplan der deutschen und russischen Seite abgestimmt. Anschließend wurde die Reiseplanung für die einzelnen Dozenten gemacht. Alle deutschen Dozenten benötigen zur Einreise in die Russische Föderation eine offizielle Einladung der Staatlichen Universität St. Petersburg. Die Antragsdauer für diese Einladung beträgt etwa vier Wochen. Mit der Einladung kann dann bei den russischen Konsulaten in Deutschland ein Visum beantragt werden. Die russische Seite organisierte die Unterkunft in St. Petersburg und

organisierte den Transfer der Dozenten innerhalb der Stadt (Flugplatz - Hotel - POMOR). Die deutsche Seite hat die Organisation der Flüge, die Reiseabrechnungen und die Hilfe bei der Reisegestaltung übernommen. Kurzfristige Änderungen des Stundenplans wurden durch die langen Vorlaufzeiten zur Erlangung eines Visums erschwert. Auf dem Petersburger Dialog 2003 wurden Reiseerleichterungen für Wissenschaftler versprochen, die leider bis heute nicht umgesetzt worden sind. In jedem Semester wurde 14 Wochen lang Unterricht mit 32 Semesterwochenstunden erteilt. Dem Unterricht schloss sich jeweils eine vierwöchige Prüfungsphase an. Zur Erleichterung des Verfahrens nahmen die deutschen Dozenten die Prüfungen am Ende ihres Unterrichtsblocks ab oder forderten schriftliche Arbeiten per Email an. Bei Nichtbestehen von Einzelprüfungen wurde den Studierenden die Möglichkeit einer Nachprüfung eingeräumt.

Im Sommer 2003 haben die Studierenden an Expeditionen in die Arktis teilgenommen, um ihre zukünftigen Arbeitsfelder kennen zu lernen. Für zwölf Studierende wurde eine Exkursion nach Spitzbergen durchgeführt, fünf Studierende nahmen an einer russisch-amerikanischen Expedition in die sibirische Laptev-See teil, drei Studierende nahmen an Exkursionen der Staatlichen Universität St. Petersburg teil. Alle Studierenden haben einen Exkursionsbericht verfasst, der sich im Anhang findet.

Im Abschlusssemester (SS 2004) führten die Studierenden gemeinsam mit den deutschen Betreuern Laborarbeiten in Deutschland durch, verfassten ihre Masterarbeiten und legten die Examen ab. Die Masterarbeiten wurden von russisch-deutschen Dozententeams betreut und geprüft. Eine Liste der Masterthemen, die ein weites Themenspektrum abbilden, findet sich im Anhang.

- Anerkennung des Studiengangs in beiden Ländern und Qualitätssicherung

Die Studierenden erhalten ein Doppeldiplom. Die Anforderungen für beide Masterdiplome sind der erfolgreiche Abschluss der Unterrichtsmodule und das Bestehen der russischen Staatsprüfung. Für den russischen Abschluss muss eine russischsprachige Masterarbeit verfasst und verteidigt werden. Für den Master der Universität Bremen muss eine englischsprachige Arbeit verfasst und angenommen werden. Das von den beteiligten Universitäten und Forschungseinrichtungen eigens entwickelte Curriculum für POMOR wurde im September 2002 vom russischen Bildungsministerium anerkannt und bildet die Grundlage für die Gestaltung der Lehre (s. Jahresbericht 2002). Hierzu mussten einige

Ausnahmeregelungen (z.B. für die englische Unterrichtssprache) geschaffen werden. Der Bremer Senator hat den Studiengang der Universität Bremen befristet anerkannt (s. Anhang).

Für die Unterrichtseinheiten der Module (Vorlesungen, Seminare, Praktika) wurden die von den russischen Behörden geforderten inhaltlichen und didaktischen Kommentare für die Pädagogische Kommission der Staatlichen Universität St. Petersburg erstellt. Diese Kommentare dienen der verbesserten Abstimmung der Unterrichtsinhalte und eingesetzten Methoden und sichern die Qualität der Lehre.

Die Studierenden mussten in allen Modulen mündliche und schriftliche Prüfungen ablegen. Das Abschlussexamen wurde an der Staatlichen Universität St. Petersburg in der Form eines Staatsexamens durchgeführt. Der Prüfungskommission saß ein von den russischen Bildungsbehörden bestellter unabhängiger Gutachter einer anderen russischen Hochschule vor. Die deutsche Seite wurde durch zwei Professoren vertreten. Das Ergebnis der russischen Prüfungen wurde von der Universität Bremen übernommen. Für die Masterarbeit wurde neben der vorgeschriebenen russischen Langfassung eine englische Kurzfassung (40 Seiten) verlangt. Die russische Form der Arbeit musste von den Studierenden in einer fakultätsoffenen Sitzung verteidigt werden. Alle 20 Studierenden haben das russische Examen und ihre russische Masterarbeit erfolgreich verteidigt (Abbildung 3).

Abb. 3: Übergabe der russischen Masterdiplome an den ersten Studienjahrgang nach erfolgreicher Verteidigung der russischen Masterarbeiten im Mai 2004.

19 Studierende haben ihre Masterarbeit in englischer Sprache verfasst und testiert bekommen. Somit haben 19 Studierende einen Master der Staatlichen Universität St. Petersburg und einen Master der Universität Bremen erhalten, ein Student schließt das Studium mit einem russischen Abschluss ab. Zum heutigen Zeitpunkt, drei Monate nach dem Abschluss, haben 18 Absolventen eine Anstellung in ihrem Fachgebiet gefunden. Die Pressemitteilung anlässlich der feierlichen Übergabe der Masterdiplome findet sich im Anhang.

- Einrichtung der Unterrichtsräume

Für den Masterstudiengang POMOR wurden Unterrichtsräume an der Geographischen Fakultät der Staatlichen Universität St. Petersburg umgebaut und eingerichtet (Abbildung 4). Die Räumlichkeiten, ein altes Großlabor, mussten komplett saniert werden. Es wurden u.a. neue Fenster mit Jalousien als Diebstahlssicherung und neue Fußböden eingebaut. Die elektrischen und sanitären Anlagen wurden ausgetauscht. So entstanden ein großer Unterrichtsraum, ein Computerraum, ein Sekretariat und ein Waschraum.

Abb. 4: Für den Masterstudiengang POMOR wurden Räumlichkeiten an der Geographischen Fakultät der Staatlichen Universität St. Petersburg umgebaut und eingerichtet. Dazu gehören ein Sekretariat, ein Computerlabor mit zehn Arbeitsplätzen und ein Unterrichtsraum für 20 Studierende.

Nach erfolgreicher Renovierung wurde neben Unterrichts- und Büromöbeln eine umfangreiche technische Ausstattung für den Unterrichtsbetrieb angeschafft. Neben Präsentationsmedien, wie Beamer und Overhead-Projektor, einem Kopierer und zwei Druckern wurden Computer für das Sekretariat und die Studierenden beschafft. Den Studierenden stand zu zweit jeweils ein Computer zur Verfügung. Die Studierenden erledigten einen Großteil ihrer Hausarbeiten und Nachbereitungen des Unterrichts in den Unterrichtsräumen.

- Gemeinsame Öffentlichkeitsarbeit

Um die Idee POMOR bekannt zu machen, wurden POMOR, das OSL und andere relevante bilaterale Wissenschaftskooperationen auf internationalen Fachtagungen und den Petersburger Dialogen in Weimar, St. Petersburg und Hamburg präsentiert. Willkommene Anlässe für die Darstellung von POMOR in der Presse waren die feierliche Eröffnung des Studiengangs (Abbildung 5), die Verleihung der Würde des Ehrendoktors der Staatlichen Universität St. Petersburg an Prof. Thiede und die Übergabe der Zeugnisse an die Studierenden. Eine Auswahl der russischen und deutschen Veröffentlichungen zu POMOR findet sich in den Anlagen.

Abb. 5: Feierliche Eröffnung des Masterstudienganges POMOR am 13.11.2002 in der Geographischen Fakultät der Staatlichen Universität St. Petersburg. An der Feier haben zahlreiche Repräsentanten des DAAD, der deutschen und russischen Bildungs- und Forschungsministerien und der beteiligten Einrichtungen teilgenommen. In Russland hat das Bildungskonzept von POMOR Modellcharakter.

Der Modellcharakter von POMOR hat sich bereits international einen Namen gemacht und führte zu Besuchen zahlreicher nationaler und internationaler Delegationen, denn die beste Werbung für POMOR sind das Können und Wissen der Studierenden. Für POMOR ist es eine Auszeichnung, dass kanadische und amerikanische Fachkollegen nach der Teilnahme der POMOR-Studierenden an einer internationalen Polarexpedition (Unterrichtseinheit: Exkursion) versucht haben, die Studierenden für weitergehende Forschungsarbeiten zu gewinnen.

Da die Gewinnung von Sponsoren für POMOR ein wichtiger Meilenstein für den Fortgang des Projektes ist, wurde im Berichtszeitraum neben einem Faltblatt zur generellen Information

über den Studiengang eine Broschüre für mögliche Förderer erstellt (s. Anhang). In der Broschüre wird der Studiengang POMOR mit seinen Lehrinhalten und Zielen dargestellt. Gleichzeitig wird die Ausbildungsinitiative in einen größeren Zusammenhang gestellt, indem bedeutende Forschungsprojekte der deutsch-russischen Zusammenarbeit im Bereich der Polar- und Meereswissenschaften dargestellt werden.

- Entwicklung weiterer Projekte in der bilateralen Zusammenarbeit

Ziel von POMOR war auch, durch die weitere Festigung der guten Wissenschaftsbeziehungen im Bereich der Polar- und Meereswissenschaften neue Kooperationen anzubahnen und die Ausweitung des gemeinsamen Studienangebots mit dem Ziel der Einrichtung einer Deutschen Fakultät in St. Petersburg voranzutreiben.

Dieses Ziel wurde in der Projektphase nicht erreicht. Gründe dafür sind vermutlich im Rückgang der Fördermittel in Deutschland für deutsch-russische Projekte und dem Fokus Deutschlands auf andere Zielländer in der Wissenschaftskooperation zu suchen. Die Einrichtung eines erweiterten Studienangebotes in Russland empfehlen wir nachdrücklich, auch um die Zusammenarbeit in den laufenden Vorhaben weiter zu stärken. Bleibt die Maßgabe der Wirtschaftlichkeit der neu einzurichtenden Studiengänge in Russland weiter erhalten, so können die Studiengänge sinnvoller Weise nur in Wissenschaftsbereichen (z.B. Jura, Wirtschaftswissenschaften) eingerichtet werden, für die die nötigen Einnahmen durch Studiengebühren zu erwarten sind.

III. Einhaltung des Kosten- und Zeitplans

Der Zeitplan des Projektes wurde eingehalten. Teilweise wurden Ziele des ursprünglichen Antrages in Absprache mit dem DAAD vorverlegt, um das Gesamtziel während der Projektlaufzeit erreichen zu können. Bei Antragstellung wurde von einem Projektbeginn im Jahr 2002 ausgegangen. Das Projekt konnte aber sofort nach Bewilligung schon im Sommer 2001 begonnen werden. Der Studienbeginn, im Antrag ursprünglich für Oktober 2003 vorgesehen, wurde auf Oktober 2002 vorverlegt. Dementsprechend mussten die Unterrichtsplanung, die Einladung der Dozenten und die Schaffung der Infrastruktur deutlich zügiger gestaltet werden. Der langwierigste Prozess, die Anerkennung des Masters, wurde rechtzeitig zum Abschluss des ersten Studienjahrgangs im Frühjahr 2004 erreicht. In

Abbildung 6 sind der ursprüngliche Zeitplan und die Zeitpunkte, zu denen gesetzten Ziele erfüllt wurden, dargestellt.

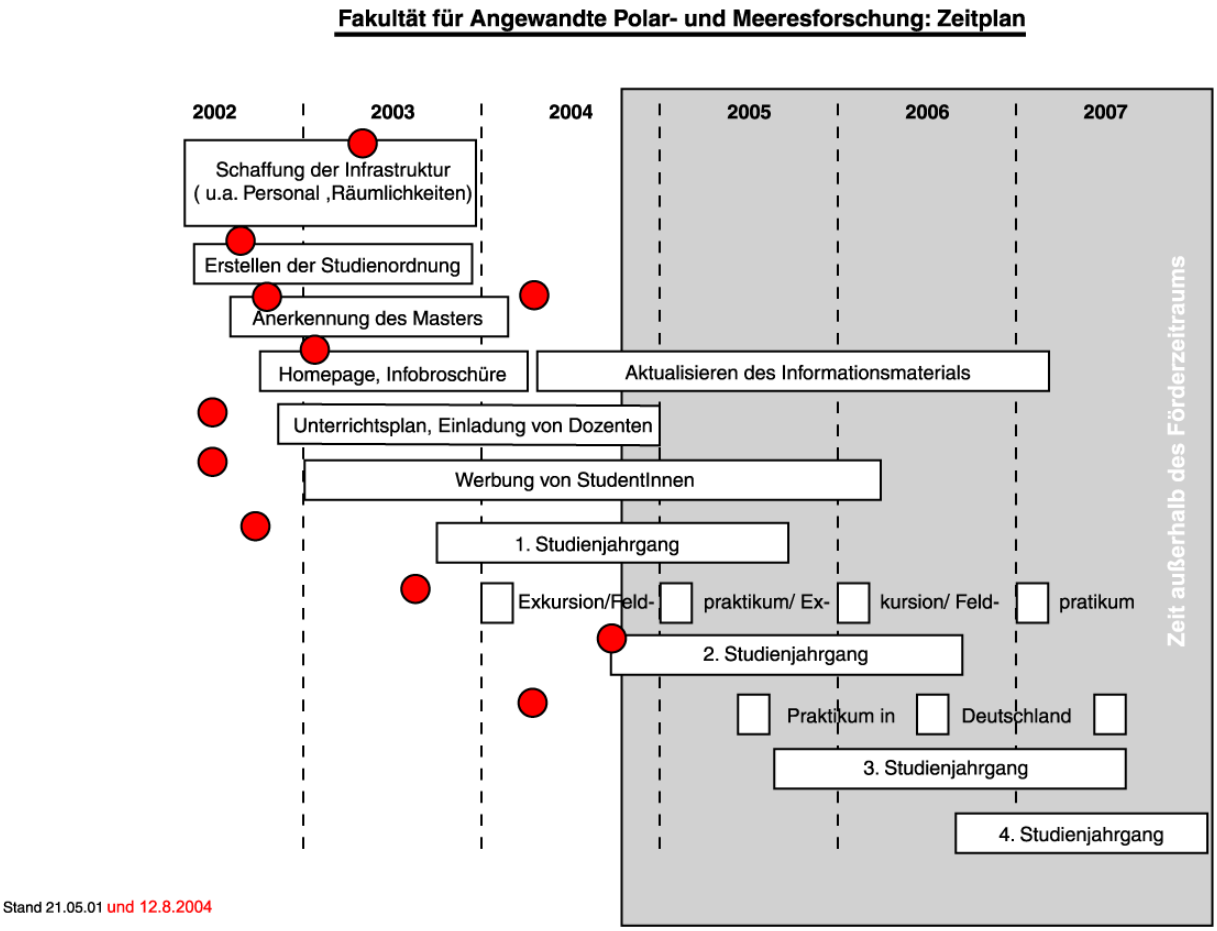

Abb. 6: Ursprünglicher Zeitplan des Antrags. In rot sind die Zeitpunkte, zu denen die Aufgaben erfüllt wurden, dargestellt. Grau hinterlegt ist der Zeitraum, der ursprünglich mit beantragt, aber nicht bewilligt wurde.

Der Kostenplan wurde weitgehend eingehalten. Durch das Vorziehen des Projektbeginns und Verzögerungen der Umbaumaßnahmen in St. Petersburg mussten im Jahr 2001 größere Summen auf das Jahr 2002 übertragen werden. Die deutliche Erhöhung der Reisekosten nach den Anschlägen vom 11. September konnte durch die Bereitstellung weiterer Reisemittel durch den DAAD aufgefangen werden.

IV. Ausblick

Im Oktober 2004 haben 16 Studierende des zweiten Studienjahrgangs ihr Studium bei POMOR aufgenommen. Dieser Studienjahrgang wird mit Mitteln des DAAD und der beteiligten Universitäten und Forschungseinrichtungen finanziert. Weitere Mittel, zunächst

für die Finanzierung z.B. der Exkursionen, werden laufend bei Sponsoren aus der Wirtschaft eingeworben. Es wurde eine Werbebroschüre (s. Anhang) entworfen, die das Programm als solches und im Kontext der deutsch-russischen Forschungszusammenarbeit beschreibt. Mit Hilfe der Sponsoren soll der Beginn des dritten Studienjahrgangs im Oktober 2006 sichergestellt werden.

V. Anhang

1. Protokoll des Arbeitstreffens in Bremen (17.-18.7.03)
2. Darstellung der Fachmodule
3. Liste der Dozenten
4. Liste der Masterthemen
5. Anerkennung des Studiengangs durch den Bremer Senator und Studienordnung
6. Deutsche und russische Zeugnisse
7. Veröffentlichungen und Öffentlichkeitsarbeit
8. Faltblatt und Broschüre
9. Exkursionsbericht - Spitzbergen

1. Protokoll

Joint Master Program POMOR – Workshop from July 17 to 18, 2003, held at the University of Bremen, Germany

Minutes

Participants:
H. Auel (UniHB), T. Bickert (UniHB), V. Dmitriev (SPBU), V. Donchenko (SPBU), P. Fröhle (Uni HRO), A. Gerdes (UniHB), J. Harff (IOW/UniHRO), V. Ionov (SPBU), H. Kassens (GEOMAR), J. Kenzler (Uni HRO), T. Klein (UniHB), C. Kemfert (UniOL), T. Klenke (UniOL), V. Movtchan (SPBU), G. Pryakhina (SPBU), R. Rendle (UniHB), J. Thiede (AWI), V. Troyan (SPBU), K. Tuschling (AWI), V. Vuglinsky (SPBU), G. Wefer (UniHB), I. Werner (UniKI), M. Wolff (AWI), A. Zhirov (SPBU)

Thursday, July 17, 2003

1. Welcome

V. Troyan, T. Bickert and K. Tuschling welcomed the participants. After a brief presentation of the agenda, all participants introduced themselves. V. Troyan pointed out that POMOR should follow the Russian tradition and should produce a booklet which includes all necessary information on the courses and modules.

2. Currents status of the project

H. Kassens informed briefly on the status of the project. POMOR started its education on October 1, 2002. The official opening took place on November 13, 2002, with contributions from the German and Russian ministries and officials, the DAAD and the partners of POMOR. In the two semesters of joint teaching almost 30 lecturers from Germany gave lectures in St. Petersburg. All of them submitted their reports to the pedagogical commission of the SPBU. There were some problems with the timetable, which led to the students being given too many lessons in some weeks. All teachers are kindly asked to stick to the planned dates. The changes due to the fact that holidays are sometimes suddenly decreed cannot be avoided. H. Kassens expressed her gratitude to the “organization team”, Vassily Dmitriev, Alexei Pokrowskii, G. Pryakhina, Olga Safonova, and Vladimir Troyan, in Petersburg. K. Tuschling added some information on the students’ excursions this summer. Six students will

take part in a Russian-American scientific cruise to the Arctic Ocean, 13 will travel to Spitsbergen and visit the scientific polar stations in Ny Ålesund. Unfortunately, the participation of four students in a UNESCO cruise has not been confirmed. The main task for POMOR apart from the teaching, excursions and the planning of the master theses will be the successful application for future funding.

3. Project planning

Although this summer approx. 100 students applied for the POMOR program, the Russian and German partners, due to the insecure financial situation and the problems to find additional rooms close to POMOR before October, decided not to have a first term start in October 2003. The participants will agree on the planning of modules 5 and 6 and all matters concerning the master theses and examinations under points 4 to 7 of the agenda.

H. Kassens informed on the changed DAAD policy, which now requires that sponsors are named for funding to be provided. H. Kassens and K. Tuschling reported on three proposals being prepared for submission to the DAAD, the Helmholtz-Gemeinschaft and the Consortium of the Universities from Northern Germany for funding the various parts of the master program. All these proposals will be submitted as soon as possible. V. Troyan informed the participants that at the SPBU it is possible to charge fees for courses if students do not have excellent education and excellent marks. J. Harff suggested to apply as well at the Krupp-Stiftung in Greifswald for funding. V. Troyan reported that Dr. Bergmann (DAAD) will only support POMOR if at least five German students take part in the program. C. Kempfert reported on a Russian-German cooperation of the Eco-Economics Department of the University of Oldenburg in Moscow, which is sponsored by EWE.

4. Curriculum

The travel organisation for the German lecturers and the high motivation of the students were considered as extremely positive. On the other hand, information on the subject matters of other modules and even details taught by others on their own modules were not clear to all lecturers. Therefore, all agreed to prepare detailed information for the web page and the booklet. All teachers should prepare 2-3 pages with the program for each course (topics, questions, plan for every lesson) and a summary of 1 page. All module leaders should write a summary for their modules. The web page should be organized according to the agreed flow chart (Fig. 1). T. Klein and K. Tuschling will prepare an example page and and instructions

for using the web page. All information should be available on the web page by September 15, 2003.

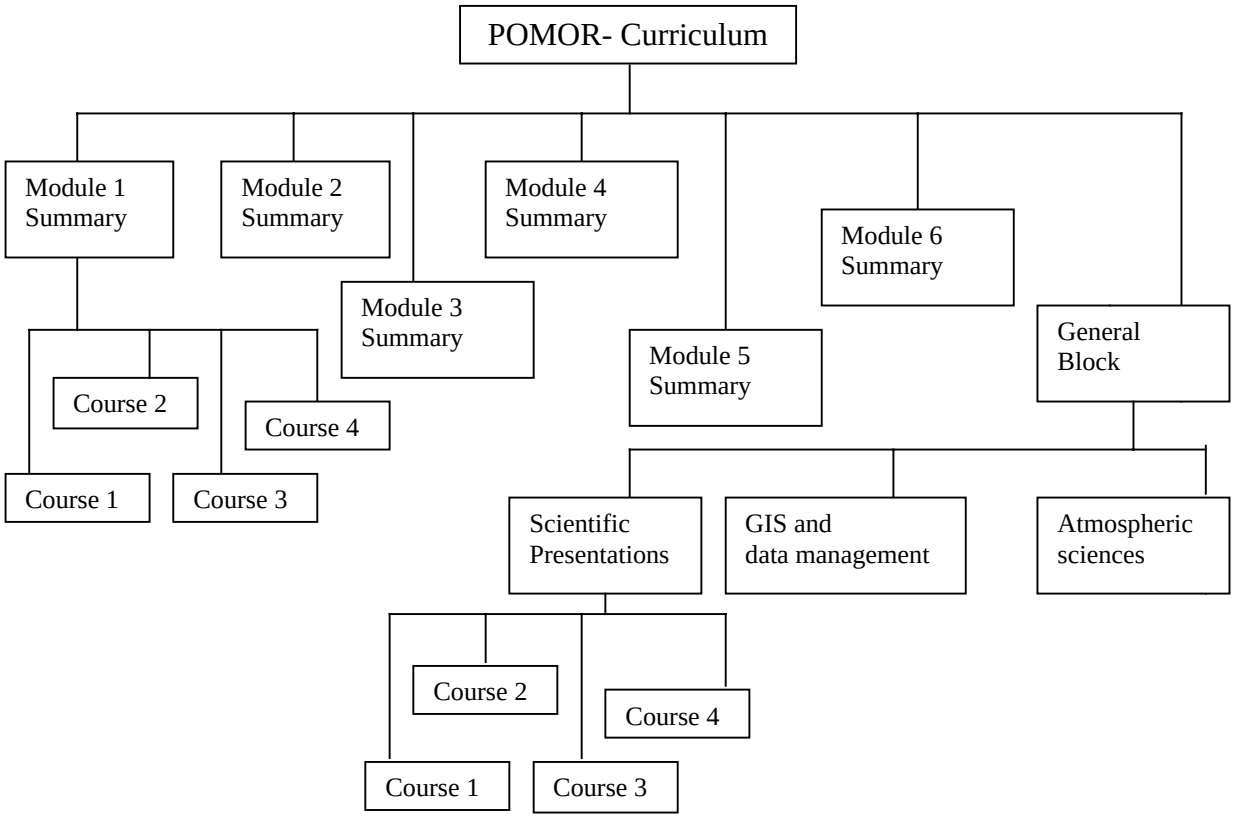

Fig. 1: Flow chart for the web-page structure

G. Pryakhina summarized the experience made on the Russian side. There are some problems and misunderstandings, which should be avoided in the future. The students wish to have one module after the other. This will not be possible due to organizational reasons. The number of lessons should be equalized. G. Pryakhina will try to comply with this proposal although in the study weeks with lessons by German lecturers more lessons will be given than in those with exclusively Russian lecturers. G. Pryakhina pointed out that in the winter terms the lessons should be given from October 1 to December 31 (exams from January 1 to January 20), and in the summer terms from February 1 to May 14 (exams from May 15 to June 1). The students should not take more than 11 exams per term, i.e., not more than five exams per module.

The group was split in working groups for the modules for the rest of the afternoon.

Friday, July 18, 2003

4. Curriculum (continued)

All working groups presented their results. The module 5 group expressed the wish to have one additional German lecturer for legal aspects. As funding for the project is limited a solution for this has to be found by the partners within the module. For the Common Block H. Kassens and K. Tuschling suggested to cancel the advanced course "Scientific presentations" in the third term. The students had an introduction to this topic in the first term and practise their skills in all modules, so an extra course to improve their presentation skills would be too theoretical. The only topic from the proposed course to be taught – writing proposals for funding – will be offered in the next term.

5. Master theses

V. Troyan explained that the Russian system for the preparation of the theses differs from the German system. In Russia students choose their master topic in their first semester and start to work on the thesis at that early stage. For POMOR an exception was made. The students should choose their topic at the beginning of their third term (October 1, 2003). All topics for the master theses (30 topics for all modules) should be sent to K. Tuschling and O. Safonova at POMOR St. Petersburg (secretariat@pomor.org) by September 15, 2003.

After a long discussion on the deliverables of the students all agreed that the students have to submit the following items for the Russian diploma by the beginning of June 2004:

- 1 scientific article (English)
- 1 publication, poster or talk
- 1 thesis (approx. 50 pages in Russian).

For the German diploma they have to submit by the end of August 2004:

- 1 English version of their thesis.

Each master thesis will be evaluated by one Russian and one German assessor.

6. Exams

For the final examination the students have

- to take their exams in English and philosophy in April 2004 (Russian examiners only)
- to defend their theses in Russian in June 2004 (Russian examiners only)
- to take an exam (20 min.) on the contents of modules 1-6 in English in June 2004.

For the exam on the modules, a catalog with 60-70 questions will be prepared. For each module 10-12 questions should be sent to K. Tuschling and O. Safonova at POMOR St. Petersburg (secretariat@pomor.org) by October 15, 2003. The questions will be the basis for the examination. With successful exams and an accepted Russian master thesis the students will be awarded their Russian master. After their English thesis has been accepted, they should be awarded their German master. G. Wefer will submit the master program to the Department of Geosciences at Bremen University for agreement. He hopes that this agreement will be made by November 2003.

7. Accreditation

K. Tuschling gave a short introduction to the advantages and the needs of the planned accreditation for POMOR as required by the European Conference in Bologna.

For the minutes:

H. Kassens and K. Tuschling

2. Fachmodule

Master of Applied Polar and Marine Sciences, St. Petersburg

Modul 1: Ocean Basins, Morphology and Sediments (Bickert, Zhirov)

14 weeks 12 hours / week (L+S 6 hours, E + P 6 hours) total hours

Ocean basin morphology, tectonic construction and dynamics (L 2) 28

- shape of ocean basins
- structure and evolution of oceanic lithosphere
- hydrothermal circulation in oceanic crust

Methods of ocean floor mapping (E 1) 14

- Nautical and bathymetric charts
- Introduction to GIS

Marine sediments and climate history (L 1 + E 1) 28

- geochemical cycles in the oceans
- biogenic and terrigenous sediment supply
- postdepositional processes
- Climate reconstruction from marine sediments

Regional marine geology (S 1) 14

- selected chapters of regional environments
- e.g. high vs. low latitude environments

Geosciences of polar regions (S 1) 14

- geomorphology of Arctic ocean and shelf
- sedimentation processes in the Arctic Ocean
- Quaternary history and engineering geology of polar region
- Arctic and Antarctic comparison

Methods in marine geosciences (P 3) 42

- analysis of a deep-sea core and stratigraphy in marine sediments
- remote sensing

Marine geotechnology (L 1 + E 1) 28

- new developments in deep-sea technology
- sampling and coring techniques
- data management in marine geociences

POMOR
Module 2:

THE HIGH SEAS AND COASTAL WATERS OCEANOGRAPHY

Prof. M. Rhein, Bremen University & Assoc. Prof. V. Ionov, St. Petersburg State University

1. Introduction to Fluid Dynamics (VL 8+ SE 8= 16).
   Prof. Dr. D. Olbers

2. Geophysical Applications of Fluid Dynamics (VL 10+ SE 8= 18).
   Assoc. Prof. V. Ionov, Prof. V. Foux

3. Introduction to Physical Oceanography (VL 10+ SE 4+ UE 4= 18).
   Dr. B. Klein

4. Ocean Waves (VL 10+SE 4+UE 4= 16).
   Prof. L. Loupatuchin, Prof. M. Foux

5. Coastal Ocean Dynamics (VL 8+ SE 4 + UE 4= 16).
   Assoc. Prof. I Shilov

6. Turbulence (VL 6 + SE 6 + UE 4= 16).
   Prof. Timokhov, Dr. B. Klein (6 - practical part)

7. Dynamic Oceanography (VL 10 + SE 6= 16).
   Assoc. Prof. V. Ionov

8. Physics of the Air-Sea Boundary Layer (VL 8+ SE 6+ UE 2= 16).
   Dr. B. Ivanov

9. Ocean measurements and Ocean Data Analysis. (VL 6 + SE 6 + UE 6= 18)
   Assoc. Prof. I. Shilov, Dr. D. Ionov

10. Advanced General Oceanography (VL 8+ SE 10= 18)
    Dr. B. Klein (6 – oceanography of tracers)
    Dr. E. Fahrbach (- Dynamics of the Antarctic Circumpolar Current)

total 168 hours

Modul 3
Ecosystem: structure and functioning
Work plan

- Courses (overview)

1. Introduction to ecology (14 hours)

Title of lecture	Teacher	Acad. hours (R)	Acad. Hours (G)
Ecol. norming	V. V. Dmitriev	2	
Ecol. problems of the Arctic	V.N. Movchan	2	
Planktic ecology	U. Bathmann		5
Benthic ecology	G. Graf		5
Sum		4	10

2. Methods of ecol. Investigations (56 hours)

Title of lecture	Teacher	Acad. hours (R)	Acad. Hours (G)
Modelling in aquatic ecosystems	Yu. N. Sergeev	18	
Ecol. norming	V. V. Dmitriev	16	
Methods in planktic ecology	U. Bathmann		5
Methods in benthic ecology	G. Graf		5
Methods in sea-ice ecology	I. Werner		2
Methods in fisheries	H. Auel		2
Community analysis and biodiversity	H. Auel		6
“Lipids in foodweb analysis”	H. Auel		2
Sum		34	22

3. Marine subsystems (28 hours)

Title of lecture	Teacher	Acad. hours (R)	Acad. Hours (G)
Role of sea ice in the Arctic Ocean	V. Yu Tretyakov	4	
Phyto- and zooplankton, food webs	U. Bathmann		5
Benthic processes	G. Graf		5
Regional examples: Baltic Sea, Wadden Sea and Deep See	G. Graf		4
Sea-ice environm. and communities	I. Werner		6
Fisheries biology	H. Auel		1
Anti-freezing proteins	H. Auel		1
Regional examples: Rocky shores and intertidals	H. Auel		2
Sum		4	24

4, Ecology of terrestrial regions (14 hours)

Title of lecture	Teacher	Acad. hours (R)	Acad. Hours (G)
Bio- and geoecology of northern territories	V.N. Movchan	14	
Sum		14	

5. Exchange between environmental systems (28 hours)

Title of lecture	Teacher	Acad. hours (R)	Acad. Hours (G)
Biogeochemical cycles	U. Bathmann		6
Benthic-pelagic coupling	G. Graf		4
Adaptations to oxygen deficincies	G. Graf		1
Ice-water interfaces	I. Werner		4
Under ice fauna	I. Werner		4
Sea ice for higher trophical levels	I. Werner		2
Sea ice publications (students work)	I. Werner		5
Global climate change and sea ice	I. Werner		2
Sum			28

6. Susceptibility of polar systems (28 hours)

Title of lecture	Teacher	Acad. hours (R)	Acad. Hours (G)
Sea ice risk assessment	V. Yu Tretyakov	4	
Arctic view on global ecol. problems	G.N. Beloserskii	6	
Radioecology in the Arctic	G.N. Beloserskii	6	
Ecol. norming	V. V. Dmitriev	4	
Ecol. risks (POPs, UV radiation)	I. Werner		2
Internet research on Ecol. risks (students work)	I. Werner		4
Sustainable management, IWC	H. Auel		2
Sum		20	8

- Content of courses, German contributions

Planktic ecology

Ulrich Bathmann, Alfred-Wegener-Institute

Course 1 (5 hours), course 2 (5 hours), course 3 (5 hours) and course 5 (6 hours)

The students will

- be introduced to the field and concepts of Biological Oceanography (Pelagic realm)
- learn the major taxonomic pelagic groups (by extracting information from data banks and internet in small students teams and present those to the entire group)
- be introduced to the methods of 1° and 2° Production (pelagic)
- compare different pelagic systems (by presenting the important features in short student talks)
- be able to understand the functioning of different pelagic
- ecosystems in global element cycle and the reaction with the
- systems to global change (temp, CO2).

The topic will be taught in theoretical and practical lessons. After the introduction of the classification of marine environments and organisms the divisions in the pelagic environments will be introduced, the different ways to characterize pelagic organisms (taxonomic, by
size, by life style) will be presented and , basic ecological terms (habitat, community etc.) and concepts (r,k strategies) will be introduced.
The abiotic boundary conditions, such as solar radiation, mixing, temperature, salinity, pressure, ocean circulation, will be reviewed as boundary abiotic conditions which are structuring marine ecosystems. The physical control of primary production (e.g. fronts, eddies) and global production will be discussed.
In the field of primary production the concepts of phytoplankton species, taxonomic classification, phytoplankton blooms, new versus regenerative versus export production will be introduced. Different methods to determine primary production (O2, 14C, FRRF) will be presented. The physiological and environmental factors determining photosynthesis (e.g. P vs I curve, photoinhibition, critical depth concepts) will be discussed and the concept of nutrient limitation (micro- and macro nutrients) and HPLC areas will be introduced
In the field of zooplankton and secondary production species incl. systematics, with their taxonomy and biology will be introduced. The vertical distribution (daily, seasonally) of zooplankton will be discussed. Different collection methods (e.g. nets, divers, acoustics); and methods to measure secondary production will be compared (e.g. lab
experiments, cohort analysis, gut fluorescence) will be introduced.
For the understanding of food webs and interactions the concepts for food chains versus those of food webs, microbial loop, energy transfer will be discused. Different pelagic ecosystems will be presented (arctic, boreal-North Atlantic-North Sea-North Pacific, tropical, antarctic, fronts, gyres).
The biogeochemical cycling of matter in the pelagic, the concept of the biological pump will be introduced and the mineral cycles and the effect of CO2 flux will be discussed

Benthic ecology

Gerd Graf, Rostock University

Course 1 (5 hours), course 2 (5 hours), course 3 (5 hours), and course 5 (5 hours)

The students will

- be introduced to the field and basic concepts of benthic ecology
- learn to identify the most important benthic processes, which determine benthic energy flow
- be introduced into basic methods of benthic primary and secondary production and bioturbation measurements
- be able to understand and compare benthic processes in selected marine systems and to relate them to the global system

The topic will be taught in theoretical and practical lessons. After the introduction of the abiotic boundary conditions in the benthos such as type of sediment, grain size, oxygen, redox potential, sulphide, bottom near currents, the important benthic processes such as animal-sediment interactions (bioturbation including models, biodeposition and bioresuspension) will be presented. Benthic boundary processes, bottom near aggregates, size class distribution of benthic animals, and a concept of ecosystem engineering will be introduced. Other main themes of benthic ecology, e.g., benthic primary production of microphytes including methods such as oxygen microprofiling and benthic secondary production, energy flow equation according to Crisp, ecological efficiencies will be part of the courses.Benthic-pelagic coupling, energy flow to benthic systems, models by Suess and Hargrave will give the students a base to understand the benthic ecosystem. As an example for the response of ecosystems to changing environmental conditions, adaptations to oxygen deficiency and anoxic conditions of benthic organisms will be discussed.

Regional examples for relevant marine ecosystems

a) Baltic Sea, Wadden Sea and Deep Sea

Gerd Graf, Rostock University

Course 3 (4hours)

The students should get an overview on different regional types of marine environments.

- the Baltic Sea, including historical and oceanographic backgrounds.
- the deep Sea, including the realm of deep-sea plains, continental slopes, hydrothermal vents and cold seeps
- the Wadden Sea as example for a benthic dominated shallow water system, including import and export to the adjacent North Sea

b) Rocky shores and intertidals

Holger Auel, Bremen University

Course 3 (2hours)

Rocky shore communities and the rocky intertidal will be introduced with the special view on the rocky shore community of Svalbard. This will be as well a preparation for field trip to Svalbard. Special attention will be put on the zonation and organism distribution patterns, and relevant abiotic and biotic factors,

Fisheries / Higher trophical levels/sustainable managenment

Holger Auel, Bremen University

Course 2 (2 hours) and course 3 (1 hour)

Marine vertebrates (fish, seabirds and marine mammals) in polar seas will be briefly introduced with special view on the important taxonomic groups, ecological adaptations and life-cycle strategies. After a short introduction to fisheries methods and fisheries biology, the history of whaling and seal culling, the role of the International Whaling Commission (IWC), And sustainable management of fish stocks and marine mammals will be taught.

Biodiversity and community analysis

Holger Auel, Bremen University

Course 2 (6 hours)

The students will learn in theoretical and practical lessons methods for quantifying biodiversity and different definitions of biodiversity. A comparison of biodiversity on the global scale, including "hot spots": coral reefs in comparison to cold-water reefs, and reasons for high biodiversity will be introduced as well as concepts for the conservation of biodiversity,

After an introduction to community analysis, students will learn about quantifying similarity, cluster analysis, dendrograms, multi-dimensional scaling. In a practical course they will carry out a quantitative analysis of zooplankton samples,calculations of different diversity indices and cumulative dominance curves based on a zooplankton data set. The will get an introduction to the PRIMER software package for community analysis.

Lipids in marine food webs/ Anti-freezing proteins

Holger Auel, Bremen University

Course 2 (2hours) and course 3 (1 hour)

The students will learns about the total lipid content, seasonal trends, energy reserves for overwintering and reproduction. Examples from zooplankton, fish and marine mammals in regard to their lipid class composition, wax ester storage versus triacylglycerol storage,fatty acid and fatty alcohol composition will be given. The use of lipid biomarkers as a tool to study diet composition and trophic level, and PUFA and omega 3 fatty acids for biotechnical use and human consumption will be introduced.
Anti-freezing proteins in Antarctic fishes and economic use (e.g. in salmon farming) will be introduced as an example of special biochemical adaptations to polar environmental conditions.

Sea ice ecology

Iris Werner, Kiel University

Course 2 (2 hours), course 3 (6 hours) and course 5 (17 hours)

The students will

- get an introduction about relevant scientific questions and methods in modern sea-ice research
- understand the basic processes leading to the formation and colonizing of sea ice
- learn about the biology and ecology of major organism groups inhabiting the sea ice
- know about the importance of sea ice for adjacent ecosystems
- learn to read, understand and extract the major points from a scientific publication

The students will learn in theoretical and practical lessons about the sea ice in different regions (Arctic, Antarctic, Baltic), its related biota and the susceptibility of the ecosystem sea ice. The ice environment will be introduced with special view on : extent, morphology, movements, cover, formation, grow, melt, ice classes, nomenclature, ponds, ridges, structure, brine-channel system, salinity, temperature, thickness, strength, energy fluxes, albedo. Different methods in sea-ice studies, like coring, cutting, sectioning, polarized light imagining, analysis of nutrients, chlorophyll, organic matter, abundance estimations of bacteria, algae, proto- and metazoans, determination of biomass, primary and bacterial

production measurements, -ice sampling, pumping, video techniques, nets, diving will be introduced.
In the field of sea-ice communities, Sea-ice algae the incorporation of organisms, bottom-, meltpond-, surface-, interior-, infiltration-, gap-, sub-ice-communities, seasonal ice colonization, major groups of sea-ice biota, vertical distribution, taxonomic composition, diversity, origin and fate, light, nutrients, temperature, salinity, photosynthesis, growth, primary production, and dark survival will be taught.
For the sea-ice fauna and under-ice fauna bacteria, viruses, microfauna, meiofauna, macrofauna, diversity, species, abundance, biomass, distribution, origin, microbial loop, food web structure, adaptations to abiotic factors, lipid storage, coupling to pelagic and benthic habitats, energy flow will be introduced. In cooperation with Holger Auel sea ice for higher trophic levels, like cryopelagic fish, seabirds, penguins, seals, whales, polar bears, will be discussed. The importance of sea ice to indegenous peoples in the Arctic will be pointed out.
To discuss a topic in modern sea-ice research individually, each student gets 1 recent publication for a short (5-10 min) presentation for the course.
Nice and only book for that part: Rita A. Horner, Sea Ice Biota, CRC Press, Boca Raton, Florida (a bit old, but there is nothing newer!)
Publications for seminar will be provided by us.

Environmental risks/ challenges

Iris Werner, Kiel University

Course 6 (6 hours)

The students will

- get an overview of existing and potential threats to the polar environments
- learn about historical, economic and political reasons for environmental pollution
- be introduced to possible management and political measures to mitigate or avoid pollution
- develop own strategies to gather and evaluate information from the internet

Environmental challenges in the Arctic and Antarctic will be introduced with special view on: Global change and impacts in the Arctic. Here causes and mechanisms, greenhouse effect, climate modells, positive albedo feedback, temperature rise, sea-ice decrease, freshening of

surface water, impacts on sea-ice communities will be discussed. The problem of persistent organic pollutants and heavy metals in the Arctic: sources, pathways, accumulation, levels in the environment, effects on organisms including men will be introduced. Environmental problems caused by industries in the Arctic will be discussed: oil and gas exploitation: sources, risks, effects, tourism: extent, activities, risks and chances, management, hunting: history, species, extent, risks, overexploitation. Ozone depletion and UV burdens in Antarctic and Arctic, reasons and mechanisms of ozon depletion, extent, effects on UV on organisms, legislation will be part of the lessons.

Selected topics of environmental challenges in the Arctic Seminar will be prepared by groups of students, who will get a topic and several adresses for an internet research, which has to be presented in short presentations for the whole course.

Helpful printed information for this part: AMAP-Report 2002 (brandnew!), Report of IPCC 2001. Almost everything of this is available in the internet.

11. Teachers (hours per course)

Name	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6	Sum
G.N. Beloserskii						12	12
V. V. Dmitriev	2	16				4	22
V. Yu Tretyakov			4			4	8
V.N. Movchan	2			14			16
Yu. N. Sergeev		18					18
U. Bathmann	5	5	5		6		21
G. Graf	5	5	9		5		24
I. Werner		2	6		17	6	31
H. Auel		10	4			2	16
Sum	14	56	28	14	28	28	168

12. Preferred time slots of German teachers

G. Graf 24.2.- 28.2.03 3 hours per day
17.3.- 21.3.03 ! Needs double entrance visa invitation!!!

U. Bathmann 17.2.- 28.2. 03

I. Werner 5.5.- 16.5.03 4 hours per day

H. Auel 5.5. – 10.5.03 4 hours per day

13. Examns

Oral examns should be taken in courses 3, 4, 5. As responsible teachers I suggest for

course 3: G. Graf
course 4: V.N. Movchan
course 5: I. Werner
Test should be taken in courses 2 (2 tests) and 6. As responsible teachers I suggest for
course 2: V.V.Dmitriev and H. Auel
course 6: G.N. Belosierskii

Non living resources: Exploration and Exploitation: Hydrocarbons, Soils, Rocks and Minerals

Partners/Teachers (alphabetical order)
Russian partners: Lopatin, Trojan, Tchistobaev, Velokanov, Zhirov
German partners: Dullo, Horn, Reijmer

Titel	hours	type	examination	credits
• Land and Leasing **(DULLO & TCHISTOBAEV)**	14	L		
14. Land description and maps				
15. Oil and gas contracts				
16. Mineral, soil and rock contracts				
17. General review of non-living resources and their significance for the steady development of countries and regions				
18. division into districts and chracteristics of polar regions				
19. normative acts (contracts) and laws for using resources in polar and marine territories				
• Economics and Risk assessment **(DULLO & HORN & TCHISTOBAEV)**	7	L(E)		1
20. Inventarization and estimation of resource costs				
21. Fundamental economic equations, Resource payments				
22. Pollution prevention and environmental safety guarantees				
23. Environmental issues, contract for complex using of lands and nature				
24. Natural resource-cycles, energy and industrial cycles of polar regions				
25. Expected value				
26. Time value of money				
27. Cash flow model				
• Wellsite methods **(DULLO)**	10	(S)	Y	2
28. Land rigs				
29. Offshore rigs				
30. Drilling techniques, mudlogging				
31. Core handling, orientation sidewall coring				
32. Drilling problems				
• Wireline methods **(REIJMER)**	14	(S,E)	Y	2
33. Open hole tools				
34. Cased hole tools				
35. Standard interpretation				
36. Difficult lithologies				

Titel	hours	type	examination	credits
• Geological methods **(REIJMER & DULLO & LOPATIN)**	32	(L,E)	Y	4
37. Lithofacies concept				
38. Mineral deposits				
39. Soil deposits				
40. Industrial rocks				
41. Hydrocarbon reservoirs				
42. Geometry of Non living resources				
43. Costal Zone resources				
44. Diagenetic aspects of reservoirs and non living deposits				
• Marine geophysical methods **(VELIKANOV)**	14	(L,E)	Y	3
45. Seismic data acquisition				
46. Synthethic seismograms				
47. Other geophysical exploration methods				
• Processing and analyses of geophysical data **(TROJAN)**	42	(E)	Y	3
48. Seismic interpretation				
49. Basic processing				
50. Forward modelling				
51. Introduction to Contouring geological data				
52. Surface models				
53. 3D models				
• Production and Engineering **(HORN)**	14	(L)		
54. Production testing				
55. Well completions				
56. Production problems				
• Reservoir Engineering methods **(HORN)**	14	(L)		
57. Petroleum reservoir fluid properties				
58. Reserves estimation				
59. Waterflooding				
60. Recultivating of onshore exploration activities				
61. Shut down of offshore activities				

Cooperative Faculty for Applied Polar and Marine Sciences at the St. Petersburg State University

Joint Master´s Program "PoMor",

Modul 5 „Coastal Zones: Processes and Management"

Russian co-ordinator: Prof. Donchenko (St. Petersburg University)
German co-ordinators: Prof. J. Harff (IOW, Greifswald University);
Dr. Thomas Klenke (Oldenburg University)

Summary

The educational programme for module 5 aims at the general overview about processes within the coastal zones and its management and the application of the methodology introduced and case studies in polar areas.
The general basics are focussed first on Land-Ocean Interactions in the coastal zones. Students will learn about coastal biogeochemical cycles in different coastal environments with special respect to natural and anthropogenic processes. The programme will particularly focus on coastal production processes and coupling between transport and turnover of introduced natural and anthropogenic materials. Exercises will be executed in chemical laboratories. Existing datasets will be used for reinterpretation of observed processes and formulation of what-if-scenarios.
Concerning the socio-economics of the coastal zone the module aims at elucidate how society and nature interfere in coastal zones. A strong emphasis is placed on economic drivers of social development which either have a significant impact on the status of the environment or are depending on the quality and quantity of inherent resources of the coastal zones. The lectures summarises these impact studies and explains the basic relations between economy and climate.
As the main tool of management of the coastal zones a framework of corresponding laws will be introduced to the students. A general introduction will help the students to understand the interaction of international conventions and treaties concerning marine environmental protection law. The Integrated Coastal Zone Management will be understood as a balancing between the dynamics and the capacity of ecosystems and the demands of the people living in the coastal region. As one of the main aims in management basic theory and methods of coastal zone engineering are taught by coastal engineers. Based on theoretical background in hydrodynamics typical examples will be demonstrated, regarding the planning process in coastal engineering and the dimensioning of structures with special emphasis on sandy beaches. In a combination between lectures and exercises the theoretical background and practise of numerical modeling will be taught. Students learn to analyse a problem and to design the conceptual model and the solution of practical tasks. Case studies come particularly from polar regions – the Baltic Sea and Barents Sea Coastal Zones (especially Russian part of the Baltic and Barents Sea).

5.1 General Overview and Basics

5.1.1. Land-Ocean Interactions

Responsible: B. von Bodungen (IOW), V. Donchenko (SPb Univ.)

Number of contact hours: 46

This combination of morning lectures and afternoon seminars and exercises will introduce coastal biogeochemical cycles in different coastal environments weith special respect to natural and anthropogenic Processes in Coastal Zones. It will particularly focus on coastal production processes and coupling between transport and turnover of introduced natural and anthropogenic materials. Exercises will use existing datasets for reinterpretation of observed processes and formulation of what-if-scenarios.

Contact hours: 5.1.1.1 – 5.1.1.2 26

5.1.1.1 Coastal Zones: the general natural characteristic. Land-Ocean Interactions. Impacts on coastal systems.

Responsible: S. Apostolov, Ph.D, J. Krylova, Ph.D, M. Smirnova (SPb Univ.)

Number of contact hours: (L/Lab) 10/8

responsible: S. Apostolov, Ph.D, J. Krylova, Ph.D, M. Smirnova

The summary

In the offered educational program the role of geochemical, biotic and anthropogenic factors in formation of coastal zones will be represented. The interaction of a land, sea and atmosphere will be shown also.

For definition of real anthropogenic influence on coastal zones of the seas it is necessary to carry out the chemical analyses and identification of a wide spectrum of pollutants, which have harmful effect upon a state of water ecosystems.

To estimate adequately a nature of chemical compounds contained in researched water object, it is essential to take into account a metabolism of biota accompanying by enrichment of environment with organic substances. A role of geochemistry of a landscape of investigated ecosystem as well as anthropogenic loading of various nature will be discussed. Consideration must be given to the atmospheric transfers of substances of natural and anthropogenic origin.

The most complete information on a state of investigated water ecosystem can result from complex application of hydrobiological, hydrochemical and hybrid methods.

To identify the organic compounds each in natural water the complex of analytical equipment is necessary with obligatory application of hybrid methods that represent a combination of instrumental chromatography with spectral detectors. The following instrument complex should be used: gas-liquid chromatographs, gas and liquid chromato-mass-spectrometrs, chromato-IR-spectrophotometrs, chromato-UV-spectrophotometrs.

Within the framework of the given course the students will be also acquainted with methods of a quantitative estimation of assimilative potentials of territories, which allow to correlate values of directly observable variables (factors) to usually unobservable (latent) resulting value. The scientific bases of an estimation of equilibrium of geotechnical systems from ratio of consumed total energy to its primary energy productivity in examined territory will be considered. The technical objects are considered as generators of entropy oppressing biota.

The offered course consists of a lecture part and laboratory practical work.

Structure of the lectures:

Lecture 1 (2 hours). Self-regulation and homeostasis of biosphere parameters. A role of alive organisms, the mechanism of fermental catalyze, influence of toxicants on activity of enzymes.

Lecture 2 (2 hours). Transmission of substance between components of biosphere. Interaction between coastal ecosystems of land and ocean. Equilibrium concentrations of a substance in system soil - water - air.

Lecture 3 (2 hours). Energy maintenance of transmission and chemical transformations of substances in biosphere. Basic laws of thermodynamics. Gibbs's energy and an opportunity of course of chemical reactions in an environment.

Lecture 4 (2 hours). Organic substances of a various nature in coastal ecosystems. Sources of their formation. Processes in which they participate.

The resume

Detection of chemical substances of an anthropogenic origin on a natural background represents a complicated problem. Natural substances can prevent to detect pollutants or give similar analytical effect. Such problem practically does not exist in study of an atmosphere. The results received at the analysis of soils also are easier for treating as against the analysis of water objects.

In connection with that the water environment is the most various under the contents of substances of a natural origin, the basic attention in lecture is given to aspects of studying of water objects.

The plan of lecture

1. Natural chemical substances of biosphere – chemical mediators or regulators of ecological processes. A variety of ecological-biochemical interactions in land and water systems with participation of attractants and repellents.

2. Concept of primary production of water bodies. Eutrophication.

The mineral substances which are necessary for creation of primary production. Extracellular production and the chemical compounds which are included in it

(metabolites and their transformed forms). Dependence of concentration of metabolites from productivity of floristic communities. Relation of qualitative composition of metabolites with species composition of photosynthesizing organisms. Necessity of overlapping of chemical-analytical methods with biological ones for avoidance of mistakes of ranking of natural substances to pollutants.

The substances stimulating eutrophication and sources of their inflow.

3. Organic contaminants of natural environments. Contaminants of different categories (the unstable compounds, proof compounds) in coastal ecosystems. Group of priority pollutants for supervision, the control and regulations.

Lecture 5 (2 hours). The methods necessary for identification of organic substances presenting in ecosystems of coastal zones.

The resume

Representation about modern methods of determination of organic substances will be given. In connection with that complex mixes of compounds are present at objects of an environment and concentration of each of them is insignificant, necessity arises for application of hybrid methods of research. Hybrid methods represent a combination of instrumental chromatography with spectral detectors.

The following instrument complex should be used: gas-liquid chromatographs, gas and liquid chromato-mass-spectrometrs, chromato-IR-spectrophotometrs, chromato-UV-spectrophotometrs allowing to **decrypt** some thousands of organic compounds. Thus the attention will be given that such complex analytical equipment practically does not enable to reveal a nature of determined substances. To solve this task the analysis of biota is necessary with use of methods allowing to determine components of the natural environment (lecture 6).

The plan of lecture

1. Representation about chromatography and modern chromatographs.

2. Spectral devices.

Principle of work of UV-spectrophotometr, IR-spectrometer and chromato-mass-spectrometr.

The limited opportunities of their application at research of complex mixes.

Representation about work of spectral devices prepares for understanding of how they can be used as detectors in chromatograph.

3. Hybrid devices. Necessity of their application.

Gas and liquid chromato-mass-spectrometrs.

Use UV-spectrophotometr and IR-spectrometer as **sensor units** in chromatographs. Chromatographs with multichannel detectors (chromato-mass-IR-Fur'e-UV-spectrometr)

Ways of decoding of known and rare compounds in mixes. The quantitative analysis.

4. Remote methods of determinations of organic substances.

Merits and demerits of these methods (probability of reception of a false information).

Necessity of their combination to natural methods of research.

At laboratory researches the principle of work of chromatograph will be shown, works with spectrophotometr in UV areas will be carried out. Thus natural samples of soils, bottom sediments, natural water (see the plan of laboratory works) will be used.

Lecture 6 (2 hours). The basic chemical parameters of the natural environment and methods of their determination.

It will be shown, as these parameters in the natural environment are interconnected.

1. The dissolved oxygen as the factor of an ecological conditions of a reservoir. Used methods of determination.
2. Representation about easily oxidized and difficultly oxidized organic substances. Use of parameter BOD (biochemical oxygen demand) as an indirect parameter of biochemical oxidation of carbon (a labile part of organic matter in sample).
3. Concept of oxidability. A method permanganic oxidability. Application of this method for oxidation of difficultly oxidized organic substances, including water humic substances.
4. Forms of phosphorus, nitrogen and silicon. The factors of the natural environment influencing the contents of these components. Relation of the content of phosphates, nitrates, nitrites with production and destruction processes in a reservoir. Ammonium nitrogen as a parameter of regenerative processes. Photocolorimetrical determination of these components.
5. Microelements as the vital components and "heavy metals ". Methods of their detection.

This material will form a basis for laboratory works (see the plan of laboratory works).

Laboratory practical work:

Lesson 1 (2 hours).

Spectral and gas-chromatography methods of detection of the contents of organic substances in water and soil. Preparation of samples for analyses. Demonstration of a difference between artificial and natural samples. 3 hours.

Lesson 2 (1 hour).

Determination of the content of "heavy metals" in water, bottom sediments, soil and a vegetative material with methods of nuclear spectrometry. Preparation of samples, the analysis, calibration on standards, determination.

Lesson 3 (1 hour).

Determination of phosphates, nitrates, nitrites, ions of ammonium, chromaticity, silicon with photocolorimetrical method. Determination of concentration of the named ions in researched water.

Lesson 4 (2 hours).

Determination of the content of the dissolved oxygen by a method of titration (according Winkler) and an electrochemical method with use of oximeters. Comparison of these methods.

Method of permanganic oxidability. Preparation of samples, the analysis, calculations.

Questions to Examinations:

1. Result the examples concerning both to land and water systems with participation of various attractants and repellents.
2. Show schematically as inorganic carbon turns in organic and to list some classes of the organic compounds included in extracellular production.
3. What it is necessary to be guided and what it is necessary to undertake to distinguish hydrocarbons of a natural origin from petroleum hydrocarbons?
4. The basic groups of priority pollutants of an environment and sources of their influent.
5. Why the combination of chromatographical separation with the spectral analysis (hybrid methods) is necessary?
6. Why it is necessary to apply chemical-analytical methods in a combination with the analysis of biota, for example, with species composition and biomass of planktonic algae?
7. Lacks of methods of remote sounding at reception of the information about slicks on a surface of water of the large water bodies.
8. Explain, why total methods of determination of organic substances not always can be used for detection of pollution of the natural environment. Explain, when BOD can serve as a parameter of impurity of water, and when there is no.
9. The basic inorganic substances and other factors of environment necessary for production of an initial organic matter. Show the circuit of formation of organic phosphorus and explain, why in water ecosystem during intensive development of algae it is possible to not find out the mineral form of phosphorus.
10. Representation about the labile dissolved organic substances of a natural and anthropogenic origin. What from them can be analysed with a gas chromatography? What not tool total method of determination of labile organic substances exists?

Background readings/information/material:

1. Drugov JU.S. Ecological analytical chemistry. M.: 2000. 434 pp.
2. Isidorov V.A. Organic chemistry of an atmosphere. SPb.: Chemistry, 1992. 288 pp.
3. Isidorov V.A. Ecological chemistry: Manual for high schools. SPb.: Chimizdat, 2001. 304 pp.
4. Novikov J.V., Lastochkina K.O., Boldina Z.N. Methods of research of quality of water of reservoirs. M.: Medicine, 1990. 400 pp.
5. Ramad F. Bases of applied ecology: Influence of the person on biosphere. L.: Gidrometeoizdat, 1981. 544 pp.
6. Skvortsov V.V., Stanislavskaja E.V., Tysjachnjuk M.S. Management by determination of an ecological condition of brooks and rivers. SPb.: NIIH SPbGU, 2000. 170 pp.

5.1.1.2 Economic aspects of development process of Coastal Zones. Kinds of economic activity in Coastal Zones.

Number of contact hours: (L/E) 2/2

responsible: V. Grigorieva

Summary

Coastal zones are suffering intense impact from human pressures, through social and economic activities such as habitation, industrializations, energy, port installation, shipping, fisheries, agriculture, recreation and tourism. This concentration is giving rise to a series of environmental problems intricately linked to the extreme fragility of coastal ecosystems and non-rational resource use, the main factors behind the degradation. Within the framework of sustainable development, planning projects for development and protection of coastal zones requires increasing attention, especially for the mutual impacts between human activities and ecosystems. Examples of potentially negative effects are the loss of biodiversity in coastal ecosystems, and the accumulation of pollutants and nutrients in coastal wetlands and in the sea. These are phenomena which can threaten the stability or the very existence of ecosystems, let alone their capacity to provide goods and services. **The Course's Modul aims** are to reinforce training and awareness actions, providing a scientific basis for understanding the processes occurring in the marine and coastal environment, as well as their interplay with anthropogenic forces and pressures. These actions are necessary to rapidly development and implement alternative strategies for sustainable development in the Arctic, Baltic and North basin, and reinforce the development of both scientific and technical, operational networks in this field of activity.

The following research lines will be studied:

1) **Evaluation of social-economic and environmental impacts caused by human activity in coastal zones**. The evaluation methods to be implemented will have a twofold role: to identify and measure the community's preferences, firstly, for their level of commitment as input in multi-criteria and multi-attribute evaluation processes, and secondly for a cost-benefit analysis of a more purely economic nature.

2**) Dialogue between natural scientists and economists** at an international level in order to establish an operative framework for the economic evaluation of environmental protection initiatives.3) Enhancement of the role of evaluation strategies as a support instrument for the decision making process with a view to Integrated Coastal Zone Management.

4) Preparation of work plans for areas which are considered crucial to environmental policy. **Cost-benefit estimates associated with various scenarios of development and local management can be defined**. This analysis could contribute to provide valid indications for environmental policy for the global management of the North and Arctic area. Particular emphasis is placed on the definition of specifically theoretical aspects, such as the adaptation and refinement of existing evaluation methodologies integrated by new evaluation approaches. This elaboration aims at resolving the new problems emerging in practical applications, as it is the case of the North and Arctic coastal context. Particularly, **different economic**

components relevant to the evaluation of planning, design and management interventions will be considered (value of use, value of option, and value of existence), and there will be a focus on operative modalities to integrate environmental impact studies, cost-benefit analyses, and multi-criteria methodologies to evaluate the alternative hypothesis in the above-mentioned fields.

Part 1 of Modul will take a period of **2-4 hours**, focuses attention on various aspects of integrated coastal area management ; a key point for sustainable development in the Arctic Basin . This part includes socio-economic aspects as well as environmental law and engineering sciences applied to clean technology.
Part 2 of Modul will be hold as Interactive Role Plain Game (**Environment-Economical Dilemma. Conflicts of Economical Interests in Coastal Zones**) during 2-4 hours. Various case studies will be presented, outlining effects of human-induced activities on the Arctic, North, Baltic coastal zones and corresponding, appropriate implementation of sustainable management strategies. Attention will be focused on land planning for socio-economic development of the Arctic and North regions, practical examples of coastal management, involving the use of modern technology.

Structure of the lectures:

Lection 1. **Kinds of economic activity in Coastal Zones.**

Part 1.1 of the course provides basic knowledge about types and **classification of coastal resources**: biological, mineral, chemical, water, energy and recreational. **Classification of human activities (more 80 kinds of human activities) in coastal areas**, including, fisheries, build shipping, transport (including freight transport and oil transportation), energy, exploration of mineral resources, mining operations, military activity, functioning ports and marinas, coastal agriculture, tourism etc. Whole all kinds of human activities create anthropogenic pressure for coastal zones. **Conception of Anthropogenic pressure and anthropogenic noises**. First group Direct anthropogenic noises: building in coastal zones, hydro technical building, dumping. Second group-Indirect anthropogenic noises: eutrophication, ingredient pollutions, toxic effects, etc.

Coastal zone and islands as environmental sensitive areas. Classification and typization of coastal zones. Functional and other dimension coastal zone values. Monetary and unmonetary values of coastal resources.
Coastal Environment Sensitivity**.** Thematic Mapping. Environmental Sensitivity Index (ESI) and Sensitivity Modelling

(Case Study: Exercise Practice Thematic Mapping of environmental sensitivity for planning and defense measures with spill oil)

Part 1.2 Economic aspects of development process of Coastal Zones

Coastal Zones as common economic space. This part will focus on the following. Socio-economic scope. Coastal resources economy.
Economic analysis of different sectors using coastal resources (energy, industry, construction, transport, shipping, agriculture, tourism etc) Land use in sensitive coastal regions. Spatial planning. Fisheries economy. Fisheries Economic Impacts and Indicators .Methodology for the Assessment of National economic Indicators in

the Fisheries sector. Quota and Licensing systems. Potential resources of the exclusive economic zone
Conception of R-Economy, Economy, D-Economy (Spangenberg, Sustainable Europe Research Institute, Germany)
Interaction social and economic aspects of development.
Social impacts: human capital, employment level, gender equality, social exclusion and poverty, health, safety, consumer rights, social capital, security
Economic impacts: macro- and micro-economic impacts, notably in terms of economic growth and competitiveness, innovation and technological development, investment, market shares and trade patterns, increases or decreases in consumer prices.
Scheme of possible sustainability targets demonstrating the economic approach (Spangenberg):
Metalevel: market economy,lifecycle responsibility
Macrolevel: open market, stability
Mesolevel: innovation networks, public-private partnership,
Microlevel: profitable companies, consumption meeting needs
Monetary Measurement: economic growth, damage cost assessment, cost benefit analysis
Tools for cost-benefits, cost effectiveness,
Multi-criteria analysis, scenario building, indicators building
Macroeconomic indicators for sustainable development in coastal zones: Total Material requirement (TMR) and Ecological Footprints, Energy flow, Environmental Utilization Space (EUS).
Microeconomic indicators.

Modul Part 2. Seminar. Interactive Role Plain Game
2.1 Environment-Economical Dilemma
Conflicts of Economical Interests in Coastal Zones

Choosing different roles by teams of students: Experts from International organizations, economic stakeholders, authorities, representatives from different sectors: transport, shipping, construction, industry, fisheries, tourism etc. Feedback-rules
Description conflict situation in costal zone and making tasks.
Preparing a successful negotiation for sustainable development of coastal zone with economic tools.
SWOT Matrix analysis (Interests, Opinion, Legitimacy, Interests of opponent, Alternatives in case of failure, Commitment)
Negotiation. Scenario building for future sustainable development of coastal zone.
Evaluation of effectiveness of negotiation. Four main principles for **Integrative Resolutions**.
ICZM considering spatial and temporal integration and stakeholders involvement for Sustainable development Coastal areas.

2.2 **Evaluation of examples of recent management activities in coastal zone: good and bad practice .**Team work and presentation. Group of students prepare for presentation, work related to economic instruments (the use of Internet and Bibliography is recommended for this task)

Experiences on Integrated Coastal Zone Management in the Baltic and North Sea (good and bad practice). Using Integrated Coastal Management and

Economics to conserve coastal resources, Interreg project BEST –7 (Experience on sustainable tourism development on 7 islands of the Baltic Sea (Bornholm, Gotland etc.)
Tools and experiences in conservation and protection of the Coastal Zone**.**
Case studies: WWF Arctic Programme
An Integrated coastal zone management programme for the coastal stretch in Baltic and North Sea. What kind of ICZM programme is suitable for region. The formulation of ICZM programme. Specific Area Management (SAM)

Checking Students:

1. Thematic test work (computer testing)
2. Making a Report about the results of Interactive Role Plain Game " Environment-Economical Dilemma. Conflicts of Economical Interests in Coastal Zones."
3. The best Report will be recommended for the Baltic University Programme (Uppsala University)

Background readings/information/material:

1. An Analysis of the Integrated Coastal Zone Management (ICZM) concept. Patrik Olsson, Anna Svenson. Master of Science Thesis, No. 400. Department of Civil and Environmental Engineering Royal Institute of Technology, KTH. Stockholm 1998, 130 p.
2. **Barbier E.B. (ed) Economics and ecology**. **New frontiers and sustainable development**.
   Bass S. Ecology and Economics in Small Islands: constructing a framework for
   sustainable development. Chapman & Hall. London 1993 205 p.
3. Concept-paper on Coastal Management- Coastal Sector Coordination and Integrated
   Coastal Planning. The SIDA Marine and Coastal Initiative. Lars Johansson and
   etc. Stockholm, September 1997
4. Disk Osborne and associates, 1993 The prospect for institutional arrangements to promote
   integrated coastal zone management. Canberra, Resource Assessment Commission. 64 pp.
5. **Ecological Guidelines for Island Development**. John McEachern and Edward L.Towle, Published with the assistance of the SIDA and the WWF. International Union for Conservation of Nature and Natural Re sources IUCN No 30. Morges, Switzerland, 1974, 65 p.
6. ENVIRO International magazine on the environment. Special issues Integrated Coastal
   Zone management August 1997, N.23
7. Evaluation and Assessment for Conservation. Ecological Guidelines for determining priorities for nature conservation. Jan F.Spellerberg. Chapman &Hall. London 260p.

8. **Environmental Management in Practice. Instruments for Environmental Management** Volume 1. Ed. B. Nath, L. Hens, P.Compton and D. Devuyst. London and
New York.1998.508 p.
9. Environmental Accounting for Sustainable Development, ed. Jusuf J.Ahmad, Salah El. Serafy. Ernst Lutz. A UNEP-World Bank . Washington D.C.100 p.
10. FAO. 1992 Sustainable Agriculture and rural Development in small island countries.
Paper presented at the FAO Interregional Conference of Small Island Countries on
Sustainable Development and Environment in Agriculture, Forestry and Fisheries. Christ
Church, Barbados, 7-10 April 1992, Rome FAO (AGR:SIC4) 21 pp. (issued also in French)
11. FAO Agro- ecological zoning. Guidelines FAO Soils Bulletin. No.73, 78 pp.
11. FAO. 1993 Guidelines for land use planning. FAO Development Series No.1, 96 p.
12. FAO/UNEP 1997 Negotiating a sustainable future for the land: structural and institutional
guidelines for land resources management in the 21 century. Rome, FAO/United nations
Environment Programme (UNEP). 60 pp.
13. Freeman, M. 1979 The benefits of environmental improvements: the theory and practice.
Baltimore. Md. USA, John Hopkins University Press.
14. Fuavao V.A. 1994. Coastal development in small Island developing states. Case study. 4
Paper prepared for the UN Global Conference on the sustainable development of small
island developing states. 15 April-6 May 1996. New York, UN, A/CONF.167/GPR5, 24 pp.
15. Guidelines for integrated coastal zone management. Post J.C. and Lundin C.G. (eds)1996.
Environment Sustainable Development Studies Monograph Series No.9 16 pp.
16. Garcia S. 1997 Indicators for sustainable development of fisheries. FAO Land and Water
Bulletin No.5, p.131-154
17. GEF/UNDP/IMO 1996 Enhancing the success of integrated coastal management.
Good practice in the formulation, design and implementation of ICM initiatives. Quezon
City, Philippines, GEF/UNDP/IMO Regional Programme for the Prevention and
management of Marine Pollution in the East Asian Seas and Coastal management Center.
MMP-EAS Technical report No.2, 32 pp.
18. GESAMP 1996a The contributions of science to integrated coastal management. GESAMP
Reports and studies No. 61, 66pp.
19. Gillett R. 1995 South Pacific islands. Demand and supply of fish and fish products in

selected areas of the world: perspectives and implications for food security. Paper
presented at the International Conference on the Sustainable Contribution of Fisheries to
Food Security, organised by the Government of Japan in collaboration with FAO, Kyoto,
Japan, 4-6 December 1995, KC/FI 95/TECH/10, p.165-79

20. **Grigalunas T.A. and Congar R. (eds) 1995 Environmental Economics for integrated coastal area management: valuation methods and policy instruments. UNEP** Regional Seas Report Studies Nairoby, No.164, 165 pp.
21. Gudbay S. 1990 A future for the coast? Proposals for a UK coastal zone management plan.
Report for the world Wide Fund for Nature from the Marine Conservation Society.
London. Marine Conservation Society.
22. **Handbook of Environmental Impact Assessment**. Volume 2. Environmental Impact Assessment in Practice: Impacts and limitations. Ed. Judith Petts Blankwell Science. Oxford. 1999. 450 p.
23. Hufscmidt M.M. et al. 1983 Environment, natural systems and development: an economic
valuation guide. Baltimore, Md, USA, John Hopkins University Press.
24. **Integrated Coastal Area Management and agriculture forestry and fisheries**
FAO Guidelines, Rome, 1998. 247p.
25. **ICAMS Consortium, 1998 Integrated coastal analysis monitoring system for operational application in coastal regions.** Technical annex to Project plan. Project funded by EU under DG 12 Environment and Climate Programme of the Fourth Framework Programme.
Integrated Coastal Analysis Monitoring System (ICAMS) London, Earth Observation
Sciences Ltd. Internal document (IC-EOS-111-PL-001)
26. Kam S.P., Paw J.N. and Loo M. 1992 The use of remote sensing and geographic
information systems in coastal zone management ICLARM Conference Proceedings, (37)
107-32
27. Landscape ecology and Geographical Information Systems. GIS Ed. Roy Hainess-Young, David R. Green and Stephen H. Cousins. London-New-York. 1993
28. Nicholls R. J. 1993 Synthesis of vulnerability analysis studies. Keynote speech delivered at
the World Coast Conference 1993. Noordwijk, The Netherlands, 1-5 November 1993
29. Nickerson D.1997 Prospectus for the Integrated Coastal Management Workshop, Alor Star, Malaysia, 20-22 October 1997
30. OECD 1991 Report on CZM: integrated policies and draft recommendations of the Council
on ICZM. Paris, CEDEX, Organisation for Economic Cooperation and development
(OECD)

31. OECD 1993 Coastal zone management: selected case studies. Paris CEDEX, OECD
32. **PROCOAST 2000. Proceeding of the Interregional Seminar on the Harmonisation of Uses and Interests in the Baltic Sea Coastal Zones.** 11-13.09.2000. Eckernforde, Germany October 2000. 100 p.
33. **PROCOAST Final Report.** June 2001. 78 p.
34. **Science and Integrated Coastal Management. Bodungen. B. Van at al. Berlin**.1999.345p.
35. Sustainable Development in Central Baltic Sea Region archipelagos and coastal zones Lars-Gunnar Bravander, Cecilia Lindblad etc. Stockholm University. November 1999.

5.1.1.3 Cultures and communities: a history, visions and politics – the indigenous peoples of Coastal Zones (St. Petersburg)

Responsible: S. Chernikova (SPb Univ,)

Number of contact hours: (L/E) 2/2

Summary

The retrospective analysis of the formation and evolution of the history of developing Coastal Zones – history of indigenous peoples developing - the main points.
General characteristics of traditional vital activity of indigenous peoples : the specific conditions, main rules and environmental aspects. Actual functioning of indigenous peoples - traditional material and spiritual culture of the North nationalities, the culture of the nature use , settlement of indigenous peoples; processes of the ethnogenesis. Description of settlements structure, traditional resources use, spiritual culture. The examples of traditional systems of settlements and traditional vital activity systems of indigenous peoples of Russia Northern Coastal Zones, their communication with a "feeding" landscape. Interrelation of culture traditions and vital activity system of indigenous peoples. Spiritual culture as the mechanism of maintenance of ecological balance in Coastal ecosystems.
Description of the modern social-demographic, economic, ecological situation of indigenous peoples of Coastal Zones. The problems in the development process of indigenous peoples of Coastal Zones: the main conflicts. Changing of traditional vital activity system in the period of industrial development of Russia North Regions, modern complex of problems of the indigenous peoples living in Coastal Zones.
The studying of how the traditional nature use culture corresponds to the principle of the reasonable sufficiency ensuring ecological safety of the North Regions and their indigenous peoples:

- the revealing of the conditions of living of indigenous peoples depending on the landscape-climatic and geo-political conditions;

- the determining of the factors ensuring ecologically safe conditions of the favorable existence of the inhabitants.

Scenarios for sustainable development of indigenous peoples of Coastal Zones, visions of Russian scientists: S. Chruschev, S. Dmitriev, K. Klokov, I. Krupnik, K. Ivanov, P. Zaidfutdim, A. Pika and others. The transition conditions of North Regions and indigenous peoples to sustainable development on the basis of traditional ecological knowledge of ethnoses and systems of nature use. Main obstacles and barriers in transition to sustainable development. Regulation of indigenous peoples interests, the role of Local Agenda 21 and public-political indigenous organisations.

Structure of the lectures:

1. History of developing Coastal Zones – history of Indigenous peoples
2. Indigenous peoples of Coastal Zones: modern social-demographic situation

3. General characteristics of traditional vital activity of indigenous peoples : the specific conditions, main rules and environmental aspects

3.1. Settlements structure
3.2. Traditional use of resources
3.3. Spiritual culture

4. The modern situation: natural resources potential and their use, social and economic development, ecological situation
5. Problems in the development process of indigenous peoples of Coastal Zones: the main conflict – traditional and industrial use of resources
6. Scenarios for sustainable development of indigenous peoples of Coastal Zones: visions of scientists
7. Regulation of indigenous peoples interests, the role of Local Agenda 21 and public activity
8. Main obstacles and barriers in transition to sustainable development

Exercises:

The main principles and rules of oriented graph modeling and system's analysis
The landscape-ethnic-economic system oriented graph. Modeling of traditional vital activity of indigenous people of Coastal Zones
Description of energy, material and information (EMI) flows of traditional vital activity in the period of self-organisation, of transformation of traditional vital activity system
Revelation of unbalance EMI of traditional vital activity system

Background readings/information/material:

1. Пика А.В., Прохоров Б.Б., Андреева Е.Н., Богословская Л.С., Мурашко Неотрадицио-нализм на Российском Севере, М: РАН, 1994. - 206 стр.
2. Иванов К.П. Проблемы этнической географии / С.-Петерб. гос. ун-т. СПб.: Изд-во С.-Петерб. ун-та, 1998. – 216 с
3. Экология этнических культур Сибири накануне 21 века/Сборник под ред. Таксами Ч.М.// СПб.: Наука, 1995. 221 с.
4. Коренные народы и охрана природы: декларация принципов WWF, Москва,
5. Клоков К.Б. Некоторые проблемы развития хозяйства коренных народов

Севера. Этногр. Исслед. Вып.3./СПб, 1996. 24.с.
6. Гумилев Л.Н. Этногенез и биосфера Земли, Ленинград, 1989.
7. Клоков К.Б Традиционние природопользование народов Севера: концепция сохранения и развития. Этногр./СПб, 1997. 91.с.
8. Куриков В.М. Стратегия развития Северных этносов, Екатеринбург – Ханты-Мансийск, 1999., 298 с.
9. LOIRA. Land-Ocean Interactions in the Russian Arctic. Implementation Plan. IASC, Moscow-Oslo, 2000. 43p.
10. Rasmussen, R.O. (1997) Arctic communities in transition. Community structure in North America and Greenland – a development involving Home Rule for Indigenous Peoples resource management. NORS - North Atlantic Regional Studies, Roskilde University, Denkmark, Naryan-Mar Conference

Questions to Examinations:

1. The problems in the development process of indigenous peoples of Coastal Zones: the main conflicts
2. General characteristics of traditional vital activity of indigenous peoples
3. Scenarios for sustainable development of indigenous peoples of Coastal Zones

5.1.1.4 Eutrophication, Monitoring and Assessment

Responsible: B. v. Bodungen, R. Peinert (IOW)

Number of contact hours: 20

Summary

This module introduces the problem of coastal water eutrophication in general and presents the Baltic Sea case in particular, using long-term data sets. Monitoring and assessment of the changes in the marine environment are addressed. Environmental directives and the role of natural scientist in the process of coastal zone management are discussed.

Structure

Key elements and processes in coastal biogeochemical cycles:
cycles of carbon, nitrogen, phosphorus, silica, oxygen, sulfur; processes along the redoxcline, biota and matter cycling, seasonality; simple Redfield-calculations;

Key processes in drainage basins and modes of material fluxes from land to sea: modes of land use;
transport and tranformation;

Basic conditions for visible eutrophication/pollution problems in coastal waters: sources for eutrophication and pollution;

temporal development;
natural conditions for promoting eutrophication – physical/topographical forcing; ors;

Indicators for environmental state change:
the theory of indicators;
development of indicators in the marine environment;
methods;

Scales of reaction and observation (monitoring) of changes in coastal seas:
the problem of differentiation between natural variability and anthropogenic driven changes;
scale problems;
a tool box for reading the environment;
variables for monitoring;
assessing the impact of human activities;

EU-Water Frame Work Directive:
introduction to environmental regulations;
reference values;
environmental quality criteria;

Natural science and Integrated Coastal Management:
the ICM-cycle; subsidiarity and adaptivity;
prognosis and communication of uncertainty;
the experimental character of management.

Questions:

Examination

1. Transport and transformation of material in the coastal environment
2. Coupling of element cycles in the coastal environment
3. Monitoring strategies and indicators for environmental change

Tests

1. Composition of matter in estuarine systems
2. Coupling of autrophic and heterotrophic processes
3. Coupling of benthic and pelagic processes in the coasal areas

Background readings:

1. General: Large Marine Ecosystems of the North Atlantic, Eds.: K.Sherman and H.R.Skjoldal, Elsevier, Amsterdam 2002
1. Regional: A System Analysis of the Baltic Sea, Eds.: F.Wulff, L.Rahm and P.Larsson, Springer , Berlin, 2001
3. Monitoring – HelcomGuidelines- Helcom Homepage www.helcom.fi/CombineManual2/CombineHome.htm

5.1.2 Socio-Economics of the Coastal Zone

Responsible: Claudia Kemfert (Oldenburg Univ.)

Number of contact hours: 10

Summary

This module aims at elucidate how society and nature interfere in coastal zones. A strong emphasis is placed on economic drivers of social development which either have a significant impact on the status of the environment or are depending on the quality and quantity of inherent resources of the coastal zones.
We consider socio economic impact as one component of the methodology for vulnerability assessment of climatic change, through economic cost- benefit analysis of coastal zones and infrastructure in particular. We incorporate attempts to ”value” natural systems, as well as the potential social and cultural impacts of climate change. The most common Methodology defined vulnerability as the country´s degree to cope with the consequences of climate change and increased sea level rise. As the IPCC (2001) summarises, socio economic impacts of climate change for coastal zones encompass negative impacts on several sectors, including tourisms, freshwater quality and supply, fisheries and aquaculture, agriculture, human settlements, financial services and human health. The number of people affected by storm surge flooding is expected to double, or even triple, in the next century. The protection of low-lying island states and nations with large deltaic areas is likely to be very costly. The adaptation to impacts of sea level rise and climate change will incorporate many tradeoffs, including environmental, economic, social and cultural values. Socio economic impacts of sea level rise tend to increase though direct losses of economic, ecological, cultural, and subsistence values by losses of lands, infrastructure and coastal habitats. Furthermore, economic impacts include changes in water management, salinity and biological activities.

This lectures summarises these impact studies and explains the basic relations between economy and climate. We will start with basics in environmental and climate economics and enforcements to introduce climate policy instruments to protect the climate and the coastal zones.
We will highlight some of the most relevant studies on economic impact assessment exemplarily by specific country studies as Estonia and Poland, Phillipines and Bangladesh. Furthermore, the economic cost studies of sea level changes to coastal areas in different countries (USA and Venezuela) will be studied and evaluated. The lecture intends to present and explain different economic cost- benefit analysis methods to evaluate alternative adaptive responses to inundation threat from climate induced sea level rise. Especially, the damages by sea level rise can increase significantly by storms because the mean water level is higher, and waves can attack higher on the shore profile.
The coastal infrastructures plays an important role especially for megacities located near the coast, like Tokyo, New York or Shanghai. People in developed coastal areas rely heavily on infrastructure to obtain economic, social and cultural benefits from the sea. They need to be protected against natural hazards such as high waves, storm surges and tsunamis. Furthermore, climate change impacts on natural systems

can have profound effects on socio economic system. We will study this in detail. A special focus ins drawn on income and poverty differences between countries. Infrastructure includes transportation, energy systems and desaster prevention facilities. We will study and discuss one example to assess impacts on infrastructure for selected examples.

The first part of this lecture encompasses the basics of environmental and climate economics and some climate policy implications. A special emphasis is drawn on the assessment of economic costs and benefits of sea level rise. In the second part of this lecture, case studies of different countries are examined and compared. These case studies focus on impacts on coastal infrastructure, socio economic impacts and the natural system and social and cultural impacts. Case studies are lectured by a special reader that collects different international articles related to this subject. Students are entitled to summarise texts and assess different viewpoints.

Structure

The following outline summarises the structure of the lecture: “Socio- Economics of Coastal Zone”

- Basics in Environmental Economics
- Basics in Climate Economics
- Economics and Policy Issues in Climate Change
- Economic Costs of Sea level Rise
- Impacts on Coastal Infrastructure
- Socio Economic Impacts and Natural system
- Social and Cultural Impacts

Master thesis can cover one or more of the above subjects; case studies are welcome. Examinations and test cover the above themes.
A Reader containing the relevant literature will be sent to the students in advance.

Questions:

Related to Reader /Case studies

Background reading:

Fankhauser: Valuing Climate Change, The Economics of the Greenhouse, 1995
William Nordhaus: Economics and Policy Issues in Climate Change, 1998, RFF, Washington
Charles Kolstadt: Environmental Economics, 1999
Schneider, Rosencranz, Niles (eds). Climate Change Policy
IPCC (2001): Climate Change 2001 , Impacts, Adaptation and Vulnerability

5.1.3 Marine Environmental Protection Law –

Responsible: J. Kenzler, U. Streufert (Rostock University)

Number of contact hours: 15

Responsible: Jana Kenzler, Ulrike Streufert (Rostock University)

Summary

In the first lecture of the module the students will get an introduction to the International Environmental Protection Law and the Law of the Sea. It will impart knowledge of traditional sources of international law, basic priniples of environmental and marine law as well as information about implementation of regulations. These basics will help the students to understand the interaction of International Conventions and Treaties concerning Marine Environmental Protection Law which will be presented later on.

Subsequently, the most important and comprehensive multilateral treaty within the UN-framework – the United Nations Convention on the Law of the Seas (UNCLOS) – will be dealt with. It regulates the demarcation of the various sea zones such as the territorial sea, continguous zone, straits, archipelagic waters, exclusive economic zone, continental shelf and the high seas. The several legal zones as well as the rights and duties within these legal sea zones for shipping, overflight, laying of cables, fishing and research will be explained.

Furthermore, the module will give a review of regulations regarding the protection of the marine environment, the development and transfer of marine technology, the international sea-bed regime and the settlement of disputes, particularly by establishing an International Tribunal for the Law of the Sea (ITLOS) in Hamburg.

Important international treaties concerning the legal and environmental regime of the Baltic Sea and the Arctic Ocean like the Helsinki Convention on Baltic Marine protection (HELCOM) and the Antarctic Treaty will be discussed furthermore. HELCOM's main goal is to protect the marine environment of the Baltic Sea from all sources of pollution and to restore and safeguard its ecological balance. The primary aim of the Antarctic Treaty is to ensure that Antarctica shall be used exclusively for peaceful purposes.

Further Treaties and Conventions on Environmental Protection Law will be presented as well. The Convention on Biological Diversity, the London Convention, the MARPOL Agreement as well as the Treaty concerning Spitzbergen will be included.

Another part of the module will be maritime safety. The lecture will chiefly enter into the question of actions regarding increased shipping safety implemented by legislative bodies and by the executive authority.

Besides, the work and the legal basis of International Organizations which deal with environmental protection, e.g. International Maritime Organization (IMO), will be considered.

In the final lecture the students will discuss several topics, for example concerning the Kyoto Protocol.

Structure

1. Introduction to the International Environmental Law and the Law of the Sea
2. United Nations Convention on the Law of the Sea (UNCLOS)
    - a. The Regime of Maritime Zones
        - aa. Territorial Sea and Contiguous Zone
        - bb. Straits
        - cc. Archipelagic States
        - dd. Exclusive Economic Zone
        - ee. Continental Shelf
        - ff. High Seas
        - gg. The Area
    - b. Other important Provisions
        - aa. Protection and Preservation of the Marine Environment

bb. Marine Scientific Research
cc. Settlement of Disputes

3. The Legal Regime of Environmental Conventions
   a. Baltic Sea Area – Helsinki Convention
   b. Excursus 1: MARPOL and London Convention
   c. Antarctica – Antarctic Treaty System
   d. Arctic – Spitzbergen Treaty
   e. Excursus 2: PSSA, Russian Environmental Law
4. International Organizations
   a. Governmental Organizations
   b. Non-governmental Organizations
5. Maritime Safety
7. Discussion Class, e.g. Modern Piracy, Kyoto Protocol

Lesson	Content
1	Introduction to the International Environmental Law and the Law of the Sea
2	United Nations Convention on the Law of the Sea (UNCLOS) – Part 1 The Regime of Maritime Zones
3	United Nations Convention on the Law of the Sea (UNCLOS) – Part 2 Other important Provisions
4	The Legal Regime of Environmental Conventions – Part 1 Helsinki, Excursus 1
5	The Legal Regime of Environmental Conventions – Part 2 Antarctica, Arctic, Excursus 2
6	International Organizations Maritime Safety
7	Discussion Class

Topic for a master thesis:

Marine sensitive areas for the entire Baltic Sea? Environmental and economical aspects.

Questions:

1. What is the size of Contiguous Zones and Exclusive Econimic Zones? What rights do they confer on coastal states?
2. What is done against Modern Piracy?
3. What rights do foreign ships enjoy within territorial waters? What obligations do they assume?
4. How can non-governental organisations achieve an improvement of environmental protection?
5. Compare the legal background of the polar regions (Arctic and Antarctic).

Background readings:

1. Kiss/Shelton International Environmental Law, New York 2000
2. Caminos Law of the Sea, Aldershot 2001
3. Platzöder/Verlaan The Baltic Sea: New develpoments in national Policies and international Cooperation, The Hague 1996

5.1.4 Integrated Coastal Zone Management

Responsible: Thomas Klenke (ICBM; Oldenburg Univ.)

Number of contact hours: 15

Summary

Coastal zones as well as adjacent terrestrial and marine areas are exposed to increasing environmental stress and vast socio-economic changes. Careful planning and management is needed in order to balance the dynamics and the capacity of ecosystems and the demands of the people living in the coastal region.

In their professional career, many of the successful students of the POMOR programme will be asked to use their knowledge to cope with problems in developing coastal terrestrial and marine regions. The module section aims to introduce these problems considering recent case studies and the related challenges rooted both in the natural and social sphere. Case studies and complex approaches will be evaluated whether they can transferred to other marine and polar regions or new approaches must be designed in order to meet the specific demands of these region.

A set of lectures, seminars and computer based sessions will sensitise students to the complexity of regional uses and supply the students with some instruments to handle these problems.

Topics:

- Concepts of regional management
- EU-principles of integrated coastal zone management
- Integration of Environmental Impact Assessments and Water Framework Directive
- Techniques of communication and mediation
- GIS for planning, monitoring, and participation
- Evaluation of examples of recent management activities: good vs. bad practice

Structure

Session I

Lecture

ICZM: Definition of a term and history of an approach
Guiding principles and key elements of ICZM: The example of EU as agreed upon in the EU Recommendations

Seminar and computer session:

Discussion on guiding principles
Work with CoastLearn

Session II

Lecture

How to implement ICZM in planning processes

Restrictions due to regulations or societal conditions
Promotion of ICZM by other instruments of spatial planning: Environmental Impact Assessment and Water Framework Directive

Seminar and computer session:

Survey on established regulations on spatial planning
Discussion of the limitations of relevant regulations
Work with CoastLearn

Session III

Lecture

Learning from the past: Examples of ICZM driven approaches to coastal challenges
Common grounds and unique features: towards unified instruments

Seminar

Evaluation of certain projects of the ICZM-Demonstration Programme
Reports to the audience and common discussion

Session IV

Lecture

Information and information processing in ICZM
Supporting decision making using GIS and models
Limitations of decision support systems

Seminar and Computer session

CoastalGIS as planning tool and monitoring purposes
Work with simple models and GIS applications

Session V

Lecture

Elucidating conflicts in the society
Participation of individuals and groups in ICZM processes
Sustaining the consensus

Seminar

Role-playing consensus meeting
Work with CoastLearn

Questions

Examinations:

- Adoption of EU ICZM regulations and mechanisms by non-member states
- ICZM vs. sectoral approaches
- **Monitoring of impacts and feed-back to the public debate**

Test:

- Maintaining of ICZM processes – Activities needed according to societal structures
- Launching of a ICZM information to the public

- **Evaluation of a small case study**

Background readings/information/material:

1. http://www.netcoast.nl/coastlearn/website/index.htm
http://europa.eu.int/comm/environment/iczm/home.htm

Coastal Zone Engineering

Responsibe: S. Kohlhase, P. Fröhle (Rosotck Univ.)

Number of contact hours: 20

Summary

Main topics of this part of the Joint Master's Programme are basics concepts and methods used in coastal engineering. Typical problems of coastal engineering tasks will be illustrated. A brief overview of design conditions to be considered and theoretical design approaches to be included in the engineering process will be given and methods for the assessment of respective input data will be outlined. Since wave action is (very often) the most important influence regarding functional and structural design of coastal structures, wave action is treated more in detail, using information from Module 2. Based on this theoretical background typical examples will be demonstrated, regarding the planning process in coastal engineering and the dimensioning of structures with special emphasis on sandy beaches.

Structure

The lectures will be completed with two exercises on Design Sea State and Structural Design

Course: calendar week 47, 20 hours = 8 Lectures (L) and 2 Exercises (E) = 10 lectures in total

Subjects of courses

1. Review of problems in engineering practice and delimination from other special fields (L)

Typical examples of coastal engineering tasks will be illustrated considering the following topics:

Coastal protection, storm floods, coastal hazards
Harbour planning and design
Offshore engineering and structures located in the sea
Hydraulic engineering in tidal rivers and estuaries

2. Basics for planning and design (L)

The lecture gives a review of design conditions and approaches to be included in the engineering process, such as
Hydrographical conditions of the planning area
Characteristics of building material used in coastal engineering
Subsoil conditions
Functional design considerations vs. structural design
Methods used to solve specific coastal engineering problems and their interrelations

3. Assessment of input data (L)

Depending on an actual problem input data must be defined regarding
Sea state and waves, esp. wave breaking
Water levels, storm surge
Current action
Ice

4. to 6. Design sea state

Since wave action is (very often) the most important influence regarding functional and structural design, wave action is treated a little more in detail where information from Module 2 will be used

4. Use of wave theories in engineering practice (L)

Topics of interest are:
Wave spectra and necessary simplifications
Definition and notation of wave parameters
Spectral parameter
Physical properties deducted from theories
Description of spectral properties
Shallow water effects and influences of structures

5. Determination of design waves/ spectra (L)

Topics of this lecture are:

Measurements of waves and spectra

Wave forcasting/ hindcasting

Statistical properties: short-term and long-term wave statistics

Local waves, waves at coastal structures

6. Illustration and discussion of exercise no 1 “Design sea state” (E)

7. to 10. Planning of coastal engineering works and dimensioning of structures

Typical examples mentioned in L1 will be treated with special emphasis on sandy beaches

7. Coastal protection (L)

Causes of coastal erosion and basic considerations on sediment budget

Classification of structures and methods to prevent shoreline retreat

Passive structures

Active coastal protection, beach nourishment

Combinations of technical methods

Recent developments

8. Protection against flooding (L)

Seadikes and revetments

Dunes and biological safeguarding measures

Tidal and storm surge barriers

Special case: urban regions

9. Coastal engineering aspects of harbour design (L)

Review of problems

Wave protection structures and introduction to design methods

Functional harbour design

Piles and pile structures

Other structures

Dredging operations and Sand-bypassing

10. Exercise no 2 “Structural design” (E)

5.1.6 Data Management, Modelling and Forecasting

Responsible: P. Fröhle (Rosotck Univ.), J. Harff (IOW), O. Makarov (SPbg Univ.)

Number of contact hours: 24

Summary

In a combination between lectures and exercises the theoretical background and practise of numerical modeling will be taught. Students learn to analyse a problem and to design the conceptual model and the solution of the practical task. The course is subdivided into three complexes. First multivariate methods of statistical data analysis will be presented based on the Russian school of mathematical geology. The second complex comprises methods of process models in order to describe particularly the hydrodynamic behaviour of the coastal zone. In the third complex a methodology embracing monitoring, conceptual and numerical models for decision making in ICZM is introduced. Students learn to operate standard PC software.

5.1.6.1 Multivariate statistics and geostatistics

Responsible: J. Harff (IOW)

Contact hours: L/E 4/4

Summary

A general overview about the possibilities of modelling in geosciences is given as a basic for understanding the role of stochastic concepts in data management, modeling and forecasting. A subdivision of models will be given in

- Type Models,
- Space Models and
- Space-Time-Models (Process Models).

Special interest is payed to

- Data Exploration (parameter estimation, variable reduction, numerical classification),
- Zonation and regionalization of the observation space,
- Interpolation and mapping.

Structure

After the general introduction (1 hour) the lesson starts with a

- Introduction to statistics (1 hour)

The n-dimensional Gauss distribution function and its parameter will be explained. The students learn to set up a data matrix and to estimate expection value vetor, covariance matrix and correlation matrix.

- Exercises with the SPSS software package (2 hours)

Based on geochemical research data from the western Baltic Sea students learn to interpret statistical parameters and the experimental correlation matrix in order to subdivide the anthropogenically influenced sediments from near coast basins from the natural background.

- Basics in geostaistics (1 hours)

An introduction into the theory of regionalized variables will be given. Students shall understand the concept of random fields and the estimation of parameter functions and interpolation (kriging).

- Exercises using the software package SURFER (3 hours)

A data set of bathymetric measurements from the Pommeranian Bight is given. Using these data the students will construct a digital elevation model of the coastal zone. The experiomental semivariogram will be fitted to a model function and universial kriging will be applied to construct the DEM.

Questions

Why are we using the random functions for the description of processes in geosciences?

What parameters and parameter functions of random variables are essential for data exploration in geosciences?

How has a sampling and measuring program to be designed for the estimation of anthropogenic influences to natural processes in coastal areas?

Background readings:

Davis, J.C., 2002, Statistics and Data Analysis in Geology.- Wiley: New York et al., 638 p.
Harff, J., W. Lemke, and K. Stattegger, 1999, Computerized Modeling of Sedimentary Systems: Berlin Heidelberg New York, Springer Verlag, 452 p.

5.1.6.2 Numerical modelling of coastal processes

Responsible: P. Fröhle (Rostock Univ.)

Contact hours: 2 Lectures (a 90 minutes) and 2 Exercises (a 90 minutes)
Subjects of courses

Structure

1. Fundamentals of numerical models
Conservation Laws and Equations of Motion
Approaches for description of important physical processes
Basic equations for the calculation of non-stationary currents and waves
Basic equations for the calculation of sediment transport
Basics of numerical methods and equation solution methods

2. Introduction to numerical models for engineering practice
SWAN (waves)
Genesis, SBEACH (sediment transport)
Mike 21 (waves, currents, sediment transport, etc.)• …

3.+ 4. Exercises using numerical models
Waves
- Wave generation
- Shallow water effects

Sediment transport
- Long-shore sediment transport
- Cross-shore sediment transport

Currents
- Tidal currents

Visualisation of results

5.1.6.3 Decision support tools and forecasting,

Responsible: O. Makarov (SPb Univ.)

Number of contact hours: (L/E) 6/2

Topic: Decision support tools and forecasting in Coastal Zones. Case study of water basin `Ladoga lake - river Neva - Gulf of Finland (8 hours).
The summary. The economic activity in the different water system (especially in the water basin "Ladoga-Neva-Gulf of Finland") will be continually increasing in scope, due to the intensification of the trade relations between Russia (St Petersburg) and

Europe under the new economic conditions. Due to this growth the Decision support tools and forecasting in Coastal Zones are extremely needed.
The aim of the course is to formulate the general concept and structure of brainware, software and hardware tools for the supporting of the decision-makers. And to make the comprehensive analysis of forecasting system specification which are available for different case study (the necessity of the short-term, medium-term forecasting and strategic planning for different coastal zones scales, etc). The general structure and the methodology of using of different models and information technologies for the ecological safety and sustainable development of coastal zone is to be given. (case study of water basin `Lake - River - Sea`). Some principles of the elaboration and promotion of the decision support tools and forecasting in Coastal Zones is to be discussed in the present course.

The modelling and forecasting tools` description is given on the base of coastal zone around water basin "Ladoga Lake – river Neva-Gulf of Finland".
The ecological state of the water system, comprising the Ladoga Lake, the Neva river, the Neva Bay and the Finnish Gulf, is rather bad. The Ladoga lake is on the critical verge of turning into eutroph state, the water quality in the Neva Bay is considered to be epidemiologically unsafe, the eastern part of the Finnish Gulf is in the process of intensive eutrophication that is dangerous to the Gulf as a whole. The ecological condition of the water system badly affects the health and genetic stability of the population of Saint-Petersburg as well as the entire region including the countries adjoining the Finnish Gulf. Saint-Petersburg is estimated to produce about 50-60% of the entire pollution of the Finnish Gulf and about 6-7% of the Baltic Sea. As a result the international community is to a great extent worried with the consequences of this situation.

The Russian Academy of Sciences in St.Petersburg and Scientific Research Centre for Ecological Safety have organized a research group of ecologists, specialists in simulation and monitoring to create the unified model of the Ladoga-Neva-Finish Gulf water system. This model will allow to evaluate the water quality, to predict the water system state due to different situations of regional management and to give recommendations to ensure drinking water quality standards.
The research team includes highly skilled scientists representing different scientific fields. A well-known expert in ecological simulation Professor V.V.Menshutkin is the first head of the team. Among the members are Prof. A.F.Alimov - academician of Russian Academy of Sciences - ecology and hydrobiology. Prof. G.P.Astrakhantsev, Dr. I.A.Neelov and Prof. L.A.Rukhovets - mathematical simulation and 3-Dhydrodynamic models ; Prof. O. Savchuk - biological simulation; Dr. L.Ju.Preobrazhensky - monitoring and hydrodynamics. Prof. O.N. Makarov – decision support integration and GIS. The research results would be of certain value to similar projects for other regions.

Structure of the course.

1. Numerical modelling of coastal processes and ecosystems (general balance, hydrodynamical, hydrobiological, sedimental model etc., integrated model for environment risk assessment). The comparison and analysis of various models of economic development which are carried out by the various countries or regions around of a Common-pool natural resources as well as common Seas or Water basins. The concept about sustainability and environment safety of the Coastal Zones development is given. – 4 hours lecture.
2. Operational systems for environmental observation and forecasting (short-, medium and long-term situation). Reliability and accuracy in environmental

observation and forecasting (case study of water basin `Ladoga lake - river Neva - Gulf of Finland) - 2 hours lecture/2 hours execise using imitation model.

Questions:

1. What is the main obstacles to combine the similar models which describing different parts of water basin?
2. What is the main obstacles to combine the different models (hydrodynamical, hydrobiological, sedimental model etc) which describing similar parts of water basin?
3. What types of models approach for the description of different parts of water basins depending on their degree of complexity?
4. What does mean sustainability of the water basin and coastal zones? What difference between them?
5. Is there connection between accuracy of the measurement and reliability of the forecast? How these factors depend on complexity of described systems?
6. What does mean imitating and developing models? When they are applied?
7. What main components in imitating model and how to operate them?

Background readings:

1. Линник В.Г. Организация картографического банка данных для автоматизированного построения карт.// Моделирование процессов экологического развития.-1986.- Вып.13.- С.63 – 66.
2. Лопатин В.Н. Вопросы моделирования и построения региональной системы экологического мониторинга.// Моделирование процессов экологического развития.- 1984.- Вып.8.- С.37 – 43.
3. Леонов А.В., Осташенко М.М., Лаптева Е.И. Математическое моделирование трансформации органического вещества и соединений фосфора в водной среде.// Водные ресурсы. – N 1.- 1991.- С. 51 – 72.
4. Лукьянчиков Н.Н. Экономико-организационный механизм управления окружающей средой и природными ресурсами.- М.: НИА –природа.-1998.- 165 С.
5. Меншуткин В.В. Имитационное моделирование водных экологических систем.- М.: Наука.- 1993.- 158 С.
6. Невская губа - опыт моделирования. СПб., СПб. Научный центр РАН, 1997, - 23,5 п.л.
7. Экоинформатика. Теория.Практика.Методы и системы./ под ред. академика РАН В.Е.Соколова. Спб., Гидрометеоиздат, 1992.--519с.
8. Gorshkov V.G. Physical and biological basis of life stability. Man, biota, environment. Berlin:Springer,1995,330p.
9. O.N. Makarov Environmental information system for rational management in the St.Petersburg redion. t “Index-97”, - St.Petersburg, Russia, 1997, p.37.

5.2. Applications and case studies in polar regions

5.2.1 Integrated Water Management System for the coastal sea area in Russia (positive and negative experience) Model elaboration for Coastal Sea area activity (general and national feature) Strategy, policy and steps of the Integrated Water Management System for the Coastal Sea area in Russia implementation

responsible: Prof. O. Makarov

Number of contact hours: (24 hours)

The summary

The economic activity in the water system "Ladoga-Neva-Gulf of Finland" will be continually increasing in scope, due to the intensification of the trade relations between Russia (St Petersburg) and Europe under the new economic conditions. But this growth is so rapid that the management system for these activities is lagging behind.

In the framework of the international programs of the Russia government the pilot project of the integrated management water system like a pilot management informational system had been developed in 1996. This project is being carried for the benefit of the authorities that control and regulate the activities in the water system. The aim of the project is the elaboration of the integrated water management system for the sustainable development and utilisation of the `Gulf of Finland -Neva river-Ladoga lake` water system. At the present stage of the project, the scientific methodology for such system is likely to be developed, taking into account the international knowledge and experience. The general structure of the methodology for the action plan selection is on the figure and elaborated in framework of the integrated management system for Baltic City near water basin `Lake - River - Sea`. The boxes, that are elaborated now, have a grey scale.

The practical realisation of this project falls into the environment management and Strategic planning area. Therefore, along with the elaboration of the integrated management system concept, clear and tactful co-ordination of the activities of the Russian interested organisations and the practical support of the project implementation are needed, taking into account local experience and available technical means.

Some principles of the project activities organisation are suggested and discussed in the present education module.

Large experience in organisation of such activities has been gained in St.Petersburg in the framework of the interdisciplinary state ordered projects. The first projects to be mentioned are - "Forecasting and decision-making system for the rehabilitation of the environmental situation in the water system "Ladoga-Neva-Neva Bay" ("Neva Bay" project) and "Elaboration of an integrated ecoinformation system for a big city (a case-study of St Petersburg)". In the course of implementation of these projects the co-operation of the leading scientists and experts from various Russian institutions was organised on the basis of St Petersburg Scientific Center of Russian Academy of Sciences. The knowledge relevant to the implementation of the water management system "Ladoga-Neva- Gulf of Finland" was combined.

In particular, the main purpose of the Neva Bay project was creation of the constantly developing analytical software for testing and forecasting the industrial activity in the region and working out the structure and composition of the monitoring system. The functioning of this system is based on the identification of the factors, affecting the quality of the Ladoga lake, Neva river and Neva Bay waters; on public health safety under any of the possible natural conditions and permissible industrial development.

The outcomes of the projects can be summarised as follow:

- elaboration of the expert-information system for the forecasting of environmental situation in Gulf of Finland;
- creation of the operational ecoinformation computer complex for the implementation of integrated water management system in the basin `Ladoga-Neva- Gulf of Finland.`

The results of these projects are analysed in this report in the context of the tasks of the present project.

The analysis of the conceptual scheme of the integrated water resources management is given; this scheme can be formed for the Ladoga-Neva- Gulf of Finland water system. As many authorities and institutions contribute to this system, the key part of the integrated water management system is the network computer center (integrated water management computer center - ICC) whose users would be all organisations having management functions in the Ladoga-Neva- Gulf of Finland water system.

The ICC should provide different users (directly or through distant terminals) whith the necessary documentions and, if requested, ask information from the monitoring stations belonging to authorities which are managing in the Ladoga-Neva- Gulf of Finland water system. In the emergency situations, ICC (through computer conference) can provide quick connection for joint discussions and effective decision making.

The ICC should afford the storage, distributed access, collection and analysis of information on the current and future state of the Ladoga-Neva-Neva Bay water system. The ICC should be an instrument of the effective joint substantiation and control of the management decisions as regards three main tasks of the Ladoga-Neva- Gulf of Finland water management system:

- strategic planning of the industrial activity, its environmental &economic assessment and elaboration of recommendations on the legislation improvement;
- current management and dispatching of the industrial activity and its consequences;
- emergency response planning and management.

To solve the above mentioned tasks, the following software will be installed at the network ICC, certified and prepared for the unified use:

1. Hydrodynamic models of the Ladoga-Neva-Neva Bay water system (including the three-dimensional hydrodynamic model simulating the consequences of the industrial activity and forecasting the appropriate changes a) on the water surface; b) in the water deep and c) in the bottom sediments. Models to assess the economic efficiency and environmental risk of the planned and current industrial activity. Hydrobiological models to assess and forecast the environmental situation in the water system.
2. Distributed database and knowledge base with a network distant address access, which is agreed upon by the data owners.
3. The means of analysis, visualisation and recording of the management documents which are a kind of network management geoinformation system.

For the pilot testing of the integrated water management system Ladoga-Neva-Neva Bay it would be practical to use as an instrument the integrated ecoinformation system of the big city.
This system is being realised as part of the co-operation agreement V.Chernomiyrdin-A.Gore as a basis for the modern environmental management system development and is installed at the Scientific-Research Center for Ecological Safety of the Russian Academy of Sciences (SPb SRCES). The organization of the planning and the management of economic activities in Ladoga-Neva-Neva Bay system based on the environmental safety criterias can be shown by the example of the computer regional management prototype, worked out by the order of St.Petersburg Administration (authors:V.V.Menshutkin, O.N.Makarov), this ideology is used in the integrated ecoinformation system for the big city. Also, it includes the three-dimensional hydrodynamic model of the Gulf of Finland (until the section Helsinki-Tallinn) which was worked out at the Institute of oceanology (author: I.A.Neelov) as a part of the Neva Bay federal project.
Remote sensing data are analyzed together with the models in unified information environment. The tasks of modelling the sedimentation processes and the processes of the surface pollutants distribution, ice and snow dynamic are solved.
The three-dimensional hydrodynamic model of the Ladoga lake (author: L.A.Ruhovetz) can be operated here, along with the expert-information system to forecast the environmental situations in Ladoga-Neva-Neva Bay water basin and other software options created by the specialists from number St-Petersburg institutions as part of the state-ordered projects. Altogether, this system forms the continuosly renewing base on the state the Ladoga-Neva-Neva Bay water basin.

Structure of the lectures:

1. What does means the Integrated Water Management System For the Coastal Sea Area in Russia (positive and negative experience). -2 hour lecture
2. The problems of the management model elaboration for Coastal Sea Area Activity (General and National feature). The Methodology for Partnership defining and clear Terms of Reference formulating. –2 hour lecture/1 hour practice.
3. Brainware, software and hardware supporting for Integrated Water Management System implementation. - 4 hour lecture.
4. Numerical modelling of coastal processes and ecosystems (general balance, hydrodynamical, hydrobiological, sedimental model etc., integrated model for environment risk assessment). – 2 hour lecture/2 hour practice.
5. Operational systems for environmental observation and forecasting (short-, medium and long-term situation). Reliability and accuracy in environmental observation and forecasting. - 2 hour lecture/2 hour practice.
6. Strategy, Policy and Steps of the Integrated Water Management System For the Coastal Sea Area in Russia implementation. 2 hour lecture/1 hour practice.

5.2.2 Specificity of the Environmental Impact Assessment (EIA) in Coastal Zones

responsible: A. Shepeleva, Ph.D

Number of contact hours: (L/E)
4/0

Summary

Industrial development in the national sectors of sea transboundary water objects raise essentially new tasks to experts in the area of ecological safety and sustainable exploitation of sea resources. The Environmental Impact Assessment (EIA) is a tool for the analysis and prognosis of consequences of industrial activity.

The EIAs of sea oil-and-gas production for the North Sea, the Gulf of Mexico as well for the Beaufort Sea are well-documented. In the course of these EIAs, many scientific and technical problems were solved for the first time. The most comprehensive generalization of oceanologic and hydrobiological data by areas of potential impact was carried out alongside the applied research on ecotoxicology, mathematical modelling of oceanologic processes, taxonomy of sea organisms, and the methodology of ecological monitoring.

The normative methodological base of the EIA started to take shape in the 90s but its formation is still behind the needs of practice. In the Russian Federation, carrying out a EIA follows the Law «On the Ecological Expertise» (1995), «Regulations on the Environment Impact Assessment in the Russian Federation» (Ministry of Protection of the Environment and Natural Resources, 1994) and a number of other departmental documents. In 1999, VNIPImorneftegaz (Research and Design Institute on Problems of Development of Oil and Gas Resources of the Continental Shelf) expounded «Methodological Instructions on the Development of the Environment Protection Part in Preproject and Project Documents at Different Stages of the Development of Sea Oil- and Gas-Fields».

In the lecture, it is supposed to dwell on concrete problems connected to ecological substantiation and support of projects on industrial development of coastal zones, in particular, the Arctic seas.

The whole activity in the Arctic seas is under extremely climatic conditions, which limit natural processes in ecosystems and aggravate negative consequences of the anthropogenic meddling. Global climatic changes have attracted special attention due to possible ecological consequences of. Against backdrop of the warming trend, there is instability of hydrological and ice conditions. Anomalies of ice conditions and the thermal condition of sea waters directly influence arrangement and maintenance of fisheries. Their ecological consequences are nonetheless important, because seasonal biological processes in the water mass and conditions of vital activity of sea birds and mammals are connected to the edge of the ice. Presence of climatic variability implies that all earlier drown conclusions on the condition of the sea environment and ecosystems are subject to continuous correction on the basis of the new data. The results of earlier researches on the background natural pollution concentrations, EIA, and natural blocks of the Feasibility Analysis (FA) inevitably become out of date. Hence, their inexpert use can result in significant economic damage. The far-sighted scientific and technical policy on ecological support of projects should provide for carrying out the hydrometeorological and ecological monitoring within the whole region affected by the consequences of the current and planned activities.

During the development and exploitation of sea resources, the pollution of the sea environment is always sharply topical. The seas of the Western Arctic are distinguished by the low level of the background natural pollution concentrations in comparison with other areas of the World Ocean. The Kola Bay and some other coastal waters, where the annual chemical and radiation monitoring of the water environment, bottom sediments, and living organisms is being carried out, is characterized by the high level of the chemical pollution.

Ensuring the ecological safety of the Arctic coastal waters, unbiased assessment of the threat connected to the presence of a large number of nuclear facilities on the Kola Peninsula and Novaya Zemlya, exploitation of military and civil nuclear fleets, release of radionuclides, is necessary.

During the execution an EIA of sea projects, special attention is given to bottom organisms (the benthos) of the high seas and the coastal zone. Molluscs, worms and other slow-moving sea animals are fine indicators of natural and anthropogenic changes of the environment. Benthos communities are exposed to the greatest danger due to the laying of underwater pipelines as well construction and exploitation of coastal facilities. However, data on the coastal zone, where the high abundance and diversity of the benthos are observed, are incomplete.

In the Barents Sea, there are more than two thousand species of bottom invertebrates, which are mainly feeding on silt or filtering the sea suspension. Many of them form the fodder for game fish or are objects of fishery. At present, the population of Kamchatka crab, which is an introduced species for the Barents Sea, is of the greatest interest and its number is quickly growing. Its concentrations are observed in the coastal areas where construction of terminals or outlets of underwater pipelines are planned.

The fishery monitoring does not cover all kinds and areas of the seas. There are no assessments of the total biomass of game fish. Quantitative and qualitative characteristics of game species essentially change from year to year due to the influence of the fishery, and, against this background, it is not always possible to determine potential and actual damage. Even during large accidents, losses of fish stocks are predicted within the limits of 1-5%.

Sea mammals and birds are closing links of sea ecosystems and therefore respond to the whole set of factors of the anthropogenic impact: pollution of the sea environment, quantitative and qualitative deterioration of the fodder, fishery withdrawal, disturbance of habitats, anxiety. A number of studies have allocated the so-called "hot spots" at the coast of the Barents Sea – the most vulnerable habitats of protected species – and determined the calendar periods, which are the most important for their vital activity (seasons of nesting, reproduction etc.). These areas are subject to regular inspection for assessment of natural dynamics and their changes due to the influence of economical activities.

During realization of concrete projects, carrying out of EIA should be supplemented with the development of nature protection technologies and systems of the integrated ecological monitoring. In the Arctic seas, the consequences of pollution are aggravated in the presence of the ice cover, which slows down the destruction of pollution spots and transfers them over a long distance. There is the wide experience of the development of mathematical models of currents, ice-drift and spills of oil and gaseous condensate, which were used in the development of emergency scenarios within the EIA structure, and which are perspective for direct ensuring of the safety of sea fisheries.

There is a need for quick and economical purification of the polluted sites as a result of the pollution occurring during exploitation of coastal facilities. Such tasks are often complicated in the Arctic, because of extreme weather conditions and the slowed down self-purification processes.

Effective development of sea resources along with the preservation and enrichment of the vulnerable natural environment is a decisive condition of sustainable development of regions and countries as a whole.

Structure of lectures

Theme 1
The concept of EIA. Industrial activities performed in coastal zones

Industrial development in the national sectors of marine trans-border water bodies poses radically new tasks on the environmentally safe and sustainable exploitation of marine resources. An instrument for scientific analysis and prediction of the consequences of industrial activities is the Environmental Impact Assessment (EIA) procedure,

Well recognized in the international practice is the EIA experience on offshore oil and gas production in the North Sea, the Gulf of Mexico, and the freezing Beaufort Sea. These works required fulfillment, for the first time, of numerous scientific and technical tasks such as the most comprehensive summarization of the oceanological and hydrobiological data for the areas potentially subjected to impact and the conductance of applied studies on ecotoxicology, mathematical modeling of oceanic processes, systematization of marine organisms, and environmental monitoring methodologies.

Theme 2
Norms and procedures underlying EIA in the Russian Federation

The norms and procedures underlying EIA in the Russian Federation (RF) have been developed since 1990s, but still lag behind the practical demands. Now, EIA is guided by the RF Law “On the Ecological Expertise” (1995) and the “Regulations on the Environmental Impact Assessment in the Russian Federation” (1994, Minpriroda), as well as by some other documents. In 1999, VNIImorneftegaz developed “Methodical Guidance on Development of the Environmental Sections of Pre-Design and Design Documents in the Various Stages of Development of Oil and Gas Deposits at Sea”.

Theme 3
Major theoretical and practical aspects of EIA for coastal zones

The lecture will cover the specific problems of ecological substantiation and accompaniment to the industrial development projects for coastal zones and Arctic seas in particular.

Climate influence

All the activities in Arctic seas are conducted under extremely difficult climatic conditions limiting the natural processes in ecosystems and aggravating the negative consequences of anthropogenic interventions. Presently, particular attention is paid to possible ecological consequences of the global climate change.

The warming trend is accompanied by hydrological and ice regime instabilities. The anomalies in the ice and thermal conditions of the sea water have a direct influence on the arrangement and exploitation of commercial catching sites at sea. The environmental consequences of these anomalies are equally important in view of the significance of the ice edge for the seasonal biological processes occurring in the water bulk and for the living activity of sea birds and mammals.

The climatic variability means that all the earlier derived body of information about the state of the marine environment and ecosystems needs permanent correction for fresh data. The data provided by the previous background studies, EIA, and nature-related blocks of the feasibility studies inevitably age; when improperly used, they can inflict a significant economic damage. A farseeing scientific and technical approach to the ecological accompaniment of the projects must provide

for hydrometeorological and environmental monitoring throughout the area affected by the current and planned activities.

Marine environment pollution

The development and exploitation of marine resources always poses the acute problem of marine environment pollution. The West Arctic seas are distinguished by low background pollution levels compared to other World Ocean areas. A high level of chemical pollution is characteristic of the Kola Peninsula and some other coastal waters whose aquatic environment, bottom sediments, and living organisms are every year subject to chemical and radiation monitoring.

The environmental safety ensuring for Arctic coastal waters requires unbiased assessment of the threat posed by numerous nuclear power objects on the Kola Peninsula and Novaya Zemlya, as well as by the Navy and civil atomic fleet and the outflow of radionuclides.

The EIA of sea-related projects pays special attention to bottom organisms (benthos) in the open sea and coastal zone. Mollusks, worms, and other little-mobile sea animals are excellent indicators of natural and anthropogenic changes occurring in the medium. Benthos communities are mostly endangered by laying submarine pipelines or construction and exploitation of the seaside objects. However, there is no sufficient body of information on the coastal zone whose benthos is characterized by enhanced abundance and diversity.

In the Barents Sea, there are over 2 thousand bottom invertebrates living predominantly on slit or filtered marine suspended matter. Many of them serve as food for commercial fish or are commercially caught themselves. Of greatest current interest are the populations of the Kamchatka crab (this is an introduced, rapidly growing in number, species in the Barents Sea). Its accumulations are found in all the coast sites intended for construction of terminals or emergence of submarine pipelines.

Not all the commercial catching species and areas are monitored; the total biomass of noncommercial fish still remains to be assessed. Commercial fishing cause the quantitative and qualitative characteristics of the commercial species to significantly fluctuate from year to year, thus preventing, in certain cases, the singling out of the potential and actual damages. According to forecasts, even large accidents will cause the loss of fish reserves within 1-5%.

Marine mammals and birds are the “terminal links” in marine ecosystems and, thus, respond to the whole totality of the anthropogenic impact factors such as marine environment pollution, quantitative and qualitative deterioration of the feed base, commercial catching, and troubles. A series of scientific investigations revealed the so-called “hot spots” on the Barents Sea coast, i.e., the most vulnerable inhabitation sites for protected species. Also revealed were the most important calendar periods for their living activity (nesting, breeding, and other seasons). These areas need regular inspections to assess the natural populations dynamic, as well as the changes due to the economic activities.

Specific features of the EIA procedure

In the course of implementation of particular projects, the EIA must be supplemented with development of environmental technologies and complex environmental monitoring systems. In Arctic seas, the pollution consequences are aggravated by the occurrence of the ice cover which inhibits the degradation of pollution spots and carries them away for long distances. There is extensive experience in development of mathematical models of streams, ice drifts, and

accidental oil and condensed gas spills; it was used in developing scenarios of emergency situations within EIA and holds promise for directly ensuring the safety of the commercial catching sites at sea.

The contamination caused by exploitation of coastal objects requires rapid and economical decontamination of the territory affected. In Arctic zone, this is often complicated by unfavorable weather conditions and slow self-purification processes.

Efficient development of marine resources in parallel with preservation and enrichment of the vulnerable natural environment is the deciding precondition to sustainable development of regions and countries as a whole.

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2. Всемирный банк, 1991. Справочное пособие по экологической оценке. В 3-х томах. — Вашингтон: Всемирный банк.
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Questions to Examinations:

1. What is the connection between the three major principles of the EIA, on the one hand, and the sustainable development ideas, on the other?
2. What are the main difficulties in introducing EIA in countries with the economy in transition?
3. What are the potential benefits from EIA for coastal zones?
4. What information must be contained in the final decision derived from the EIA data for coastal zones?
5. In Russia and other countries, the decisions based on the EIA data are made by the state ecological expertise bodies guided by the appropriate legislation. What are the benefits of such a system in view of the specific features of the EIA for coastal zones?
6. What methods are suitable for predicting the impact when projecting industrial activities in coastal zones?
7. What is the reason for analyzing the ecological consequences of the “zero option” (rejected activity)?
8. What are the difficulties in application of methods for economic assessment of the impact when projecting and implementing industrial activities in coastal zones?

5.2.3 Environmental approaches to environmental safety in the coastal zones International conventions and agreements on environmental protection in Arctic zone Experience in international cooperation in Arctic zone

Environmental approaches to environmental safety in the coastal zones (the program in detail)

Responsible: V. Donchenko (SPbU)

Number of contact hours: (L/E) 4/0

Lecture: *Environmental approaches to environmental safety in the coastal zones*
(A Summary)

1. The recent twenty years have witnessed sharp intensification of the economic development of Arcic zone. Abundant mineral resources were explored

directly in Arctic zone; in particular, large oil and gas reserves were revealed and exploited.

The infrastructure development in mining, as well as in oil and gas extraction, industries predetermines the basic structure of the sources of technogenic impact on the natural environment. New economic activities come into conflict with the nature use patterns customary for Arctic zone. Particular importance in the economic development of northern areas is assigned to coastal zones of northern seas and the estuaries of large rivers they take. These areas are characterized by high levels of economic development and enhanced technogenic impacts on the natural environment.

The specific feature of the problem of the environmental safety of highly economically developed coastal zones consists in elaboration and implementation of a model of complex balanced development of natural and economic systems.

Coastal nature-economy systems include the coastal line-separated terrestrial and aquatic components and, thus, the terrestrial and aquatic ecosystems. This is responsible for the major specific feature of the environmental safety problem in management of the present and future economic activities in these areas.

2. Several classifications of coastal zones are currently used in scientific and practical work.

In environmental safety, no generally accepted classification has been developed as yet.

The lecture suggests a complex approach to classification of coastal zones.

3. From the practical viewpoint, of primary importance are coastal zones accommodating various economic activities.

The features specific of coastal zones are setting enhanced requirements on the environmental safety of enterprises and organizations belonging to various economy sectors.

The environmental condition of coastal zones is strongly affected by settlements, especially by big cities and megalopolises.

However, this subject requires separate investigation.

4. The concept of the impact exerted on the natural environment of coastal zones implies determining the acceptable risk level for the impact sources (economic activity) and impact objects (aquatic and terrestrial ecosystems, human health).

In the case of impact sources, this means satisfying the acting (both national and international) norms and regulations restricting the natural environment pollution.

In the case of impact objects, this means maintaining safe levels of the biotic and abiotic factors in the natural environment components (air, water, and soils).

5. Meeting the acceptable risk levels is a difficult practical task. There appear uncertainties whose resolution implies continuous monitoring of the environmental pollution. The existing monitoring systems measure the specially listed characteristics of the abiotic and biotic impact factors and the state of the natural environmental.

These measurements are made on the prescribed schedule rather than on the real-time scale. The measured data from the conventional monitoring systems are used in administration systems for management of the environmental safety of coastal zones.

These administration systems are presently supplemented by adaptive systems for management of the environmental safety of coastal zones. These adaptive systems are mainly distinguished by the real-time operation.

Adaptive management systems comprise an environmental safety observatory with a synthesizing center and a reference network of stations at the impact sources and impact objects. The measuring blocks of the reference network stations are equipped with sensors providing the real-time information to the synthesizing center; these are able of independent operation within a maximal period of time.

Adaptive management systems offer prospects for ensuring the environmental safety in a certain mode.

6. Taking the coastal zone of the Russian section of the Gulf of Finland as an example, the lecture will summarize items 1-5; the students will be invited to discuss the prospects for management of sustainable environmentally safe development of coastal zones.

Lecture: *International conventions and agreements on environmental protection in Arctic zone (the program in detail)*

1. International ecological law. Major development phases.

2. The UN participation in preparation and adoption of international ecological law-related documents.

3. An analytical overview of the major international conventions and agreements aimed at sustainable environmentally safe development of Arctic zone.

4. Brief characterization of the practical experience in application of international ecological law procedures to environmental safety ensuring in coastal zones of northern regions.

5. The prospects for development of international cooperation on the environmental safety of coastal zones of northern seas.

Lecture: *International conventions and agreements on environmental protection in Arctic zone (A Summary)*

1. Based on the impact exerted on the natural environment by humans, the history of the civilization can be subdivided into three stages: pre-industrial (until the 19th century), industrial (19-20th centuries), and post-industrial (from the end of the 20th century till the present time) stages.

Each of these stages has its specific laws directed toward nature conservation.

Ancient civilizations originated from and developed in river deltas. In those times, the people's life was strongly dependent on the nature. Early states (Egypt, Babylon, Ancient Greece, Rome) had laws protecting the natural environment. Examples of such laws can be found in the Middle Ages as well.

The industrial revolution of the 19th century has laid the foundation of the powerful industrial society of the 20th century.

In the 20th century, the scope of the impact exerted on the natural environment by our civilization has reached a maximum. The ecological crisis has become a global challenge.

Of great importance for realization of this problem and emergence of a new, environmental, consciousness were the woks by the Club of Rome in the 1970s.

2. This time period can be regarded as the onset of formation of the industrial ecological law.

From the very beginning, the new principles, mechanisms, and procedures for the international ecological law have been formulated under the aegis of the United Nations.

The major documents were adopted by the Stockholm Conference (1972) of the UN Commission for Sustainable Development under leadership of G. Bruntland (1987), by the Earth Summit for the Environment and Development (Rio-de-Janeiro, 1992), and the Earth Summit for Sustainable Development (Johannesburg, 2002).

The UN activities on creation of the modern ecological law were fixed by international conventions and agreements.

3. The list of these conventions and agreements is rather extensive. Here, we will cite only those directly connected to the management of environmentally safe development of coastal zones in the Arctic region.

4. The lecture will briefly characterize the practical experience in application of international ecological law procedures, with the Convention on the Baltic Sea marine environment protection (Helcom) as an example.

5. The prospects for development of international cooperation on the environmental safety of coastal zones in northern seas are treated with a view to practical application of the main points of international conventions and agreements.

The students will be invited to discuss the urgency of preparation and adoption of the international convention “On Collective Environmental Safety of Arctic Seas”.

The possible structure and the main items of this convention will be discussed. A question as to the possible content of the Convention item on management of sustainable environmentally safe development of coastal zones in Arctic region will be posed.

Lecture: ***Experiences in international cooperation in Arctic zone (program in detail)***

1. Main spheres of international cooperation on environmental studies of Arctic zone.

2. International programs aimed at studying the environmental changes occurred in Arctic zone in recent decades.

3. International cooperation priorities and prospects adopted by the International Arctic Scientific Council.

4. A project on establishment of international Arctic environmental safety observatory on the Spitsbergen island.

Lecture: ***Experiences in international cooperation in Arctic zone (A Summary)***

1. Much progress has been achieved in environmental studies of Arctic zone due to international programs, above all, the ACSYS (Arctic Climate System Study) program.

Also, a number of new programs have been recently developed. An example can be found in the multidisciplinary SEARCH program for studying the environmental changes in Arctic zone. It is primarily concerned with a complex study of the environmental changes that occurred in the Arctic zone in recent decades. The program is designed as long-term developments based on the data from observations, complex studies of various processes, and applied research on the five major themes:

— human society (socioeconomic development),
— marine and terrestrial biospheres,
— ocean,
— numerical modeling-based complex developments and assessments.

Interdisciplinary studies are conducted under the Arctic environment systems studies (ARCSS) program. Several international projects are being implemented under this program.

2. The Conference of the International Arctic Study Committee (IASC) has suggested four scientific priorities:

1. Arctic processes affecting the global systems.
2. Global change impact on the Arctic zone and its inhabitants.
3. Nature ecodynamics in Arctic zone,
4. Sustainable development in Arctic zone.

The greatest significance is assigned to the following global change components: terrestrial ecosystems, glacier and ice sheet mass balance, regional cumulative impacts, and Human Dimensions (socioeconomic aspects).

3. The ACSYS program is constituted, essentially, by the five sections: 1) ocean circulation, 2) sea ice cover climatology, 3) Arctic atmosphere, 4) water cycle, and 5) numerical modeling. The ACSYS program utilizes the data of observations being conducted since 1994 and those of simulation numerical modeling of the Arctic ecodynamics, with a view to achievement of the three main objectives:

1. Understanding the Arctic Ocean circulation, ice cover, and water cycle interaction mechanisms.
2. Initiating the Arctic climate long-term studies and the relevant monitoring programs.
3. Providing the scientific substantiation to the Arctic processes with a view, in particular, to using the results in global climate modeling,
4. The ACSYS-constituting program for Arctic ocean circulation studies comprises four projects:

1. Hydrographic monitoring of the Arctic Ocean with the aim to create a representative base of high-quality hydrographic data.
2. World Ocean shelf studies with the aim to understand the shelf processes responsible for separation of saline and fresh components of seawater, as well as to study the shelf water dynamics and thermodynamics and other processes.
3. Arctic Ocean variability study concerned, above all, with the space structure of the circulation and density of seawater.

Creation of an Arctic Ocean climate database suitable for verification of climate models and investigation of the climate change-related processes.

The main objectives of the ARCSS program for systems studies of the Arctic environment are as follows:

1. A deeper insight into the physical, geological, chemical, biological, and socio-cultural processes in Arctic zone as interacting with global process and, thereby,

the contribution made by regional processes into formation of global processes and vice versa.

2. Improvement of the scientific basics for predicting the environmental changes on time scales from within a season to centuries; substantiation of policy decisions as the response to the global change impact on humans and life-support systems.

The achievement of these objectives relies upon developments along the four lines:

— Understanding the nature of global and regional impacts of the Arctic climate system and its variability.
— Assessing the importance of the Arctic zone in global biogeochemical cycle formation.
— Identifying the global impacts and variability of the Arctic climate system.
— Revealing interconnections between environmental changes and human economic activity.

3. Studies on the current state of the natural environment in Western Arctic sector validate the topicality of the development of a program for complex interdisciplinary studies on the real-time assessment of the impact from the natural and anthropogenic factors on Arctic marine and terrestrial ecosystems.

The primary objective of the first stage of this program is to create a telemetering system for environmental safety (TSES) of Western Arctic sector. The TSES provides for real-time integrated monitoring of characteristics of naturally and anthropogenically originated biotic and abiotic factors for the typical zones(objects) in the region of interest.

The TSES measuring stations form the reference network of the Arctic observatory for environmental safety (AOES).

The AOES comprises the main measuring complex (for which the Spitsbergen island is a reasonable site), the TSES reference network, and the synthesizing center for environmental safety (SCES) with a base at SRCES RAS.

5.2.4 Strategy of SD for Yamal-Nenets autonomous district (St. Petersburg)

Responsible: G. Voropaeva

Number of contact hours: (L/S)
4/0

Summary

1. An analysis of the social-economic aspects of the Yamal-Nenets autonomous district is an essential part of the system studies of the region. It offers the possibility to understand and assess the integrity of natural and social processes and to see their interdependence. For people who live in the coastal zone, a state of marine and terrestrial environment has a determined role in their lives, while the available complex of natural resources defines their economy.

2. The Yamal-Nenets autonomous district has its own peculiarities. On the one hand, the area represents a very old traditional economy of local indigenous people, nenets, such as reindeer-breeding and fishing, hunting on wild marine animals. On

the other hand - the region has quite new oil and gas activities which began to develop in the post-soviet period, in the early 90's under the rules and laws of market economy. Therefore, this process differs from similar ones in other oil and gas regions of Russia. As a result, no rapid growth of population, nor appearance of resource towns are planned.

3. Thirty years of geological survey and reconnaissance of the northern part of the famous oil-gas Timan-Pechora province, located at the territory of two administrative regions – Komi Republic and Nenets autonomous okrug – formed the basis for current rapid industrial development. The successful results of geological works put the Nenets autonomous region on the same level with the main suppliers of oil and gas in Russia during the third millenium. In accordance with the geological estimates the potential hydrocarbon reserves achieved 2.4 bln. tonnes of oil and 1.17 trln. cubic meters of natural gas in 1998, and discovered 76 oil and gas fields. Difficult natural conditions and inadequate infrastructure delay an industrial development of the resources. Only five fields were under exploitation by 2000 with an output of around 5 mln. tonnes of oil and 500 mln. cubic meters of natural gas, while by 2005 it will be increased more than three times (17.2 mln. tones) and by 2010 growth of output will be more than 4 times (23.7). Prospective area for oil and gas occupies more than two thirds of the territory of the Nenets okrug while today 73% of the okrug's territory are used as reindeer pastures. This means that major land-use conflict will develop between the oil industry and the traditional economy (which is based on biological resources crucial for the preservation of the local indigenous population's ethnic identity and social status.

4. The Pechora region, Nenets autonomous okrug, in the "European" part of the Russian Federation, is distinguished by its extremely scarce number of settlements and low of population: only 46 thousand people live on 176 thousand square kilometers. More than half the population is concentrated in the okrug administrative center – Narjan-Mar. The social and demographic situation of this okrug reflects the negative processes common for the whole Russian North: high migration from the region, low life expectancy, high infant mortality rate and high death rate among working-age people. The worsening of the demographic situation has particular relevance for aboriginal peoples who live in rural areas and often have weak adaptive capabilities to the stresses of economic reforms in regional life.

5. Nenets autonomous district and its population are bearing the consequences of the impact of atomic tests in the archipelago Novaya Zemlya, which took place from 1957 to 1990. The total capacity of nuclear explosions conducted during this period was 233 megatons or 94% of all nuclear weapon tests in the Soviet Union. There are no systematic data about the direct influence of nuclear tests on the state of the population's health, but statistical daviation of health indicators in comparison with other northern regions point to certain connections. Specialists assume that the increase in cases of tumors and pathology of pregnancy, congenital anomaloes, skin diseases, diseases of the endocrine system and blood-forming organs, is a result of long-term exposure to small doses of radiation.

6. Pechora region has its own complex of natural resources which form the basis of its present and future social-economic development. Oil and gas deposits are only a part of this complex and their exploitation should not lead to the exhaustion of other ones, such as fish resources, pasture lands, pure fresh water, particularly because of

the great significance of these resources for local people. In addition, renewable resources are of such high quality and valuable from an ecological point of view they represent a real natural heritage for this “European” part of Russia. For this purpose, concepts for sustainable resource use on sustainable base has been elaborated by social and natural scientists together, in cooperation with lawyers, to recommend new rules and laws for resource management in the arctic coastal zone. The local initiatives for the regulation of land use under oil activities and construction that were elaborated by the local committee on land resources should be developed on the basis of scientific analysis of natural and social data (taking into account the latest federal laws about protection of rights of indigenous peoples) for further implementation in the region.

7. Creation of the system of the protected areas in NAO has a strong support of the local authorities and indigenous population. It's considered as a significant factor in sence on maintaining of the ecological balance of the arctic territory. In future it's logically to expect a growing conflict between oil companies and local resource management structures as the most perspective oil and gas fields are located within borders of existed and planned protected areas, particularly in coastal zone.

8. Design of The SD Strategy for Yamal-Nenets autonomous district is aimed to integrated resolution of complex social, economic, political and environmental problems. Main obstacles and barriers in transition to sustainable development of Yamal-Nenets autonomous district.

Structure of the lectures:

1. Arctic Sustainable Development Strategy: general principles, goals, targets.

2. Yamal-Nenets autonomous district – pilot region for design of Sustainable Development Strategy for Russian Arctic.

3. General characteristics of Yamal-Nenets autonomous district (administrative-political, social-economic, geographi_, environmental).
   - Administrative set-up and political status.
   - Social-demographic situation.
   - Population and its demographic features.
     - Demographic trends, migratory processes, labor forces, unemployment.
     - Medical-social situation.
     - Indigenous people and their problems.
     - Economic development.
     - Natural resource potential and its use in Yamal-Nenets autonomous district.
   - Non-renewable resources (oil and gas resources, up-date state of oil industry, gas industry development, oil delivering to consumers).
   - Renewable resources (pasture resources for reindeer-herding, up-date state of reindeer-herding as the main indigenous branch of northern agriculture, fishery resources, resources of marine mammal hunting).
   - Ecological situation in the Yamal-Nenets autonomous district (air pollution from local sources, natural water contamination, protected areas).

4. Key problems and main conflict zones of Yamal-Nenets autonomous district: social, economic, political and environmental. Main conflict – traditional and industrial resource use.

5. Seeking of conflict resolution instruments. Legal regulation regarding indigenous Interests in the Yamal-Nenets autonomous district (federal laws, local legal regulative acts, role and structure of public-political indigenous organizations).

6. Design of The Sustainable Development Strategy for Yamal-Nenets autonomous district, aimed to integrated resolution of complex social, economic, political and environmental problems.

7. Main obstacles and barriers in transition to sustainable development of Yamal-Nenets autonomous district.

FIGURES

1. Industrial and social infrastructure system of the NAO
2. Distribution of the NAO population by sel'skie sovety including Nenets
3. Scheme of the NAO oil and gas resource development.
4. Distributed licenses on oil and gas fields in the NAO to Jan.2000.
5. Reindeer pastures of the agricultural production cooperatives.
6. The NAO traditional economy and protected areas.

TABLES

1. Distribution of Nenets people in Russia, 1990.
2. Dynamics of the NAO population during 1990-1996 years (thousand of people to the 1st of January).
3. Dynamics of the population of NAO including the share of Nenets people.
4. Number of migrants who arrived in and left the NAO regarding directions of their migrations (in % to the total number of migrants, 1995).
5. Indicators of natural growth and migration in the changes of the NAO population.
6. Resource potential of the Timan-Pechora Province.
7. Oil and gas resources of NAO and Komi Republic.
8. The Perspective Pechora Sea oil-bearing structures.
9. The list of license holders in the Nenets Autonomous Okrug.
10. Oil and gas production in NAO 1984-1999.
11. Structure of the NAO land fund (Jan.2000).
12. Pasture reindeer capacity and number of reindeers in the NAO agricultural holdings (1996)
13. Industrial and municipal emissions in atmosphere, 1996.
14. Total volume of contaminants, tons/year.

Background readings/information/material:

Андреева Е.Н. Проблема интегрированного природопользования в рамках международного проекта "Взаимодействие суши-океана в Российской Арктике" В кн. «Город в Заполярье и окружающая среда». Труды 2-ой

Международной конференции (Нарьян-Мар 10-12 сентября, 1997) Сыктывкар, 1998. С. 287-299.
Велихов А., Вяхирев Р. Программа освоения нефтегазовых ресурсов на арктическом шельфе Российской Федерации: основные принципы и приоритеты. РАО «Газпром» –Росшельф. М., 1994.
Воропаева Г.М. Проблемы перехода к устойчивому развитию регионов. В кн. «Город в Заполярье и окружающая среда». Труды 2-ой Международной конференции (Нарьян-Мар 10-12 сентября, 1997) Сыктывкар, 1998. С. 59-63.
Петрякова О.Л.. Демографические проблемы Европейского Севера РФ. В сб. «Социальные и демографические проблемы современной России: статистический анализ». Москва, МЭСИ, 2000. С.28-37.
Печорское море. Системные исследования. (под ред. Е.А.Романкевича) ИО им. П.П. Ширшова РАН, М. 2003. 430 стр.
Пика А.В., Прохоров Б.Б., Андреева Е.Н., Богословская Л.С., Мурашко О. Неотрадиционализм на Российском Севере. М: РАН, 1994. 206 стр.
Регламент согласования и утверждения документов при осуществлении производственно-хозяйственной деятельности по промышленному освоению природных ресурсов на территории Ненецкого автономного округа. Комитет земельных ресурсов НАО. Нарьян-Мар, 1998.
Рябиков А.Д. Проблемы здровоохранения Ненецкого автономного округа. «Город в Заполярье и окружающая среда». Труды 2-ой Международной конференции (Нарьян-Мар 10-12 сентября, 1997) Сыктывкар, 1998. С.385-389.
ФЦП «Комплексного освоения нефтегазовых ресурсов Тимано-Печорской провинции до 2005 и в последующие годы». Том 1. Технико-экономические показатели. РАО «Газпром»- НК «Лукойл». Москва, 2000.
Andreeva E.N. The Northern Sea Route: Impacts on the Nenets Autonomous Okrug regional development and social/economic conditions of the Nenets population. INSROP Working Paper No. 148 – 1999, IV.4.1. Oslo, 1999. 113p.
LOIRA. Land-Ocean Interactions in the Russian Arctic. Implementation Plan. IASC, Moscow-Oslo, 2000. 43p.

POMOR - Master Program for Applied Polar and Marine Sciences
Modul 6: Periglacial Systems (1.10.2003 to 16.1.2004)
by
Heidemarie Kassens and Valery Vuglinsky

Subject	Lecture	University lecturer	Hours	Period
I	**The Perigiacial Environment**		**27 h**	
	- Introduction	Vuglinsky, SPbU	3 h	
	- Periglacial water bodies	Vuglinsky, SPbU	10 h	
	- Methods of periglacial investigations	Chistyakov, SPbU	14 h	
II	**Present-day Periglacial Environments**		**30 h**	
	- Permafrost and ground ice	Are, PSUMC	4 h	09. –
	- Active layer and Cryosols	Pfeiffer, Uni HH	12 h	10.10.03
	- Basic cryogenic processes	Chistyakov, SPbU	6 h	13. –
	- Periglacial landforms	Chistyakov, SPbU	6 h	17.10.03
	- Gashydrates	Are, PSUMC	2 h	
				November 03
III	**Water resources and hydrological aspects**		**40 h**	
	- River runoff formation in Polar regions	Vuglinsky, SPbU	7 h	
	- Water resources of Arctic rivers and their variability	Vuglinsky, SPbU	7 h	
	- Specific features of Arctic rivers runoff during different phases of water regime	Vuglinsky, SPbU	7 h	
	- Ice regime of Arctic rivers. Ice jams and ice dams	Hubberten, AWI-Potsdam	12 h	27.-31.10.03
	- Stable isotopes in hydrology and periglacial systems			
IV	**Microbiology and Biogeochemical Cycles in Arctic Environments**		**20 h**	8..-12.12.03
	The Arctic environment as a habitat for microorganisms	Knoblauch, Uni HH	2 h	
	- Marine, shelf and coastal sediments	Wagner, AWI-Potsdam	2 h	
	- Permafrost soils and sediments			
	Arctic microbial biota and their metabolisms	Knoblauch, Uni HH	2 h	
	- Carbon cycle in marine environments	Knoblauch, Uni HH	2 h	
	- Transformation of Iron and Manganese	Wagner, AWI-Potsdam	2 h	
	- Carbon cycle and global change aspects in tundra environments	Wagner, AWI-Potsdam	1 h	
	- Nitrogen cycle	Wagner, AWI-Potsdam	2 h	
	Methods in environmental microbiology	Knoblauch, Uni HH	2 h	
	- Classical microbiological methods	Wagner, AWI-Potsdam	1 h	
	- Molecular ecological methods			
	- Relevance of permafrost ecosystems to astrobiology	Knoblauch, Uni HH; Wagner, AWI-Potsdam	4 h	

	- Seminars			
V	**Geotechnical and engineering aspects of perigiacial environments** - Geotechnical properties of frozen soil - Specific features of construction in permafrost territories - Specific features of point, linear and areal anthropogenic impacts on natural complexes - Specific features of hydrological computations in the permafrost zone	 Chistyakov, SPbU Are, PSUMC Are, PSUMC Vuglinsky, SPbU	**18 h** 4 h 4 h 4 h 6 h	 December 03 December 03
VI	**Global change and perigiacial environments** - Evidence and impact of global change on cold regions - Global changes and permafrost degradation	 Anisimov, SPBU Vuglinsky, SPbU	**10 h** 7 h 3 h	 December 03
VII	**Excursion**		**23 h**	

Subject	**Vuglinsky SPbU**	**Chistyakov SpbU**	**Are PSUMC**	**Pfeiffer Uni HH**	**Hubberten AWI**	**Knoblauch Uni HH**	**Wagner AWI**
I	13	14					
II		12	6	12			
III	28				12		
IV						10	10
V	6	4	8				
VI	3						
VII							
Summe	**50**	**30**	**14**	**12**	**12**	**10**	**10**

Total: 138 h (incl. excursion 168 h)

Common block: UE – Scientific presentations

- Introduction (2 hours)

All subjects of the course, theneeds for the practical work of the students and the rules for certification will be introduced.

- Oral presentation (3 x 4 hours)

The main precepts for preparing a talk will be given. The subject of the talk as well as the auditorium and its previous knowledge should be taken into account. To build up a structure of a talk will be one of the first goals of this class. Later the basic knowledge on lay-out and the effects of different colours, fonts etc. will be imparted. Powerpoint will be used by all students to create an own talk. After training all students shall present their short talk to the class for certification.

- Literature (4 hours)

Finding literature in order to discuss scientific problems is the main aspect of this course. This should be done in libraries or via the internet. The application of literature programms, such as End Note and File Maker, will be explained. In addition focus will be put on the correct citation of papers, books, etc.

- Databases (4 hours)

In this general introduction to information management systems an overview will be given to databanks and information systems such as GIS. The application of such information systems to real world problems is the main goal of the course.

- Web pages (3 x 4 hours)

The contruction and design of a web page will be explained in this course. In small teams the students should develope their own web page, which introduces them and their main scientific interest. Finally the web pages should be used to apply for the work placements .

- Scientific publications (4 hours)

The course will describe and explain the way of writing a scientific article (manuscript order and structure, citations, figures, tables etc.).

- Poster design (2*4 hours)

This course deals with the principles of designing a scientific poster in order to present specific scientific problems. The students are asked to design a poster in order to present scientific resuls for a braod community such as on a scientific conference. This includes also the application of computer programs such as Coral Draw, Adobe Illustrator.

- Public Relations (4 hours)

The course will show and discuss how specific scientific problems can be addressed to a broad community without a scientific background. The main focus will be given to short articles and notes in journals and / or newspapers. The students are asked to write a short note in terms of the master program.

- How to raise money in sciences (4 hours)

The students will get an introduction to different funding agencies in Russia and Europe in order to be able to raise money for certain scientific projects. This includes writing of a scientific proposal incl. budget estimation as well as writing of reports.

10. Summary (2 hours)

POMOR master program for applied polar and marine sciences
Block Database and GIS - 20 hours lecture (12.-16.May 2003)

"**Applying Geo-Information Systems in marine geosciences**"

by Dr. Angela Schaefer (Alfred Wegener Institute, Bremerhaven, Germany)

This course will give an introduction into principles of GIS on the basis of examples in marine geosciences. Basic GIS-concepts of capturing spatial features from various sources, data integration, data structure, geo-referencing and projecting, data modelling, typology, data overlay, information retrieval and relevant mapmaking will be presented. These concepts will be demonstrated with actual standard GIS-software, hence the students will be able to reproduce contents of teaching and to start advanced self-study. Joint discussion and collection of ideas will take place to think out further GIS-applications with the content of teaching of the POMOR master program for applied polar and marine sciences, e.g. marine resource management, marine habitat mapping, coastal zone management, risk assessment in marine and polar ecosystems. Finally the internet will be indicated as a valuable sources of information on GIS and cartographic issues and spatial data mining.

3. Liste der Dozenten

POMOR: Teachers and representatives of Modules 1-6 and the common block

Module 1: Ocean basins, morphology and sediments

Wefer, Bickert (Uni HB) and Zhirov (SPBU)

Name	University/ Institute
Waldmann, Christoph	Uni HB
Meinecke, Gerrit	Uni HB
Lamy, Frank	Uni HB
Arz, Helge	Uni HB
Stein, Rüdiger	AWI
Rendle, Rebecca	Uni HB
Postnov, I. B.	SPBU
Kuznetsov, V.U.	SPBU
Musatov, U.E.	SPBU
Lastochkin, A.N	SPBU
Zhirov, A.I.	SPBU
Aliev, T.A.	SPBU

Module 2: High seas and coastal water oceanography

Rheine (Uni HB) and Ionov (SPBU)

Name	University/ Institute
Birgit Klein	Uni HB
Eberhard Fahrbach	AWI
Ursula Schauer	AWI
Loupatouchin, L.I.	SPBU
Ionov, V.V.	SPBU
Timokhov, L.A	AARI
Foux, V.R	SPBU
Shilov, I.O.	SPBU
Ivanov, B.V.	AARI

Module 3: Ecosystems: structure and functioning

Movchan, Dmitriev (SPBU) and Tuschling (AWI)

Name	University/ Institute
Holger Auel	Uni HB
Gerd Graf	Uni Rostock
Iris Werner	Uni Kiel
Uli Bathmann	AWI
Dmitriev, V.I.	SPBU
Mochchan	SPBU
div. NN	SPBU

Module 4: Non-living resources

Zhirov, Troyan (SPBU) and Dullo, Reijmer (GEOMAR)

Name	**University/ Institute**
W.-Chr. Dullo	GEOMAR
John Reijmer	GEOMAR
D. Horn	c/o GEOMAR via J. Reijmer
Tchistobaev	SPBU
Lopatin	SPBU
Velikanov	SPBU
Troyan	SPBU

Module 5: Coastal systems: processes and management

Donchenko (SPBU), Klenke (Uni OL) and Harff (IOW)

Name	**University/ Institute**
J. Harff	IOW, Uni Greifswald
T. Klenke	Uni Oldenburg
B. v. Bodungen	IOW, Uni Rostock
T. Fröhle	Uni Rostock
S. Streufert	Uni Rostock
Kohlhase	Uni Rostock
Donchenko	SPBU
Voropaeve	SPBU
Makarov	SPBU
Apostolov	SPBU
Grigorieva	SPBU
Shepleva	SPBU
Kryolova	SPBU
Smirnova	SPBU

Module 6: Polar systems

Dmitriev (SPBU), Kassens (GEOMAR) and Pfeiffer (UniHH)

Name	**University/ Institute**
D. Wagner	AWI
E.-M. Pfeiffer	Uni HH
C. Knoblauch	Uni HH
H. Hubberten	AWI
Vuglinsky	SPBU
Chisyakov	SPBU
Are	PSUMOC

Common block :

English:
S. Andriyechenko und E. Tarasova (SPBU)

German:
N. Kakhro (SPBU)

History and methodology in Science:
Vinogradov, U.B. (SPBU)
J. Thiede (AWI)

Scientific presentations
Kassens (GEOMAR), Diepenbroeck (Uni HB) and Tuschling (AWI)

Name	**University/ Institute**
Huber, Robert	Uni HB
Diepenbroek, Michael	Uni HB
Gerdes, Albert	Uni HB
Dittert, Nicolas	Uni HB
Rendle, Rebecca	Uni HB
Kassens, Heidi	GEOMAR
Tuschling, Kirsten	AWI
Drachev, Sergej	VNIIO
Klein, Thorsten	Uni HB
Schäfer, Angela	AWI

4. Liste der Masterthemen

Master topics and Travel Plans POMOR (20.2.2004)

Module 1

Master topic	Supervisors proposed by Dr. Bickert	Student	Comments
Terrigenous sediment supply in the Artic Ocean: Characteristics, quantification and variability	R. Stein, AWI-Bremerhaven A. Zhirov, SpbU	Helen Razyvaeva	- Program submitted - visit to Bremerhaven
Paleoenvironmental reconstruction based on planktonic foraminifera in the sub-polar realm	R. Rendle and S. Steinke, University of Bremen A. Zhirov, SpbU	Maria Surovtseva	- Program submitted - Visit to Bremen

Module 2

Master topic	Supervisors proposed by Prof. Timokhov	Student	Comments
Statistics of thermohaline intrusions on shelf slope of the Laptev Sea	L. Timokhov, AARI-OSL, St. Petersburg U. Schauer, AWI-Bremerhaven	Gennady Bogatyrev	Program submitted Visit to AWI-remerhaven,
Variability of the temperature and salinity of surface layer in the East Siberian and Laptev seas	L. Timokhov, AARI-OSL, St. Petersburg E. Fahrbach, AWI-Bremerhaven	Nikolay Koldynov	Program submitted Visit to AWI-remerhaven
Spatial and temporal variability of oxygen, silicate, phosphate and nitrate in the Laptev Sea in summer	L. Timokhov, AARI-OSL, St. Petersburg J. Hoelemann, AWI-Bremerhaven	Mikhail Makhotin	- Program submitted - visit to Kiel
Interannual cold halocline variability in the Laptev sea on the base of winter hydrographic expeditions	L. Timokhov, AARI-OSL, St. Petersburg U. Schauer, AWI-Bremerhaven	Anna Akimova	Program submitted Visit to AWI-remerhaven
Spatial and temporal variability of biochemical oxygen demand in the Laptev Sea	V. Dimitriev, SpbU J. Hoelemann, AWI-Bremerhaven	Natalia Markova	- Program submitted - visit to Kiel
Tidal drainage zones of the White Sea	V.R. Fuks, SPbU, St. Petersburg S. Kohlhase, P. Fröhle University of Greifswald	Roman Smagin	- Program submitted visit to Warnemünde

Module 3

Master topic	Supervisors proposed by Dr. Werner	Student	Comments
Potential impact of global warming and shrinking arctic sea-ice cover on sympagic meiofauna (metazoans); Part A and B	I. Werner, IPOE, University of Kiel G. Belozersky, SpbU	Olga Preobra-zhenskaya Anastasia. Moshkina	- Program submitted - 15.3.-15.4.2004 visit to Kiel

Module 5

Master topic	Supervisors proposed by Prof. Harff	Student	Comments
Indicators of marine environmental change	Bodo von Bodungen, BSRI, Warnemuende S. A. Apostolov, SpbU	Tatayana Alekseeva	rogram submitted isit to Kiel
Conditions of indigenous peoples sustainable development of Coastal Zones (case study Republic Komi)	S.A. Chernikova, SpbU T. Klenke, University of Oldernburg	Irina Ivanova	-Programm submitted, -visit to Oldenburg
Legal and environmental regime of the Baltic Sea	N. Alekseeva, SpbU W. Erbguth, J. Kenzler University of Rostock	Anna. Korobkina	- Program submitted - visit to Rostock planned
Strategic environmental impact assessment	Thomas Klenke, ICBM, Oldenburg O. Makarov, SpbU	Natalia Vaganova	- Program submitted - visit to Oldenburg
Methodology of regional modeling the coastal system - applied to the Gulf of Finland	J. Harff, BSRI, Warnemünde O.N. Makarov, SpbU	Dauren Khassanov	- Program submitted Visit to Warnemuende

Additional topics

Master topic	Supervisors proposed by Dr. Neuber	Student	Comments
Intercomparison of balloon borne water vapour soundings in the Arctic	R. Neuber, AWI-Potsdam/ U. Leiterer, Observatory Lindenberg G. Menzhylin, SpbU	Darya Vasilyeva	- Program submitted - Visit to Finland and Germany Potsdam
Assesment of possible ecological consequenses and risk estimation from oil and gas industry in northern seas Part A and B	W.-C. Dullo, GEOMAR G. Belozersky, SpbU	Irena.Polovodova Anna Nikoulina	- Program submitted - Visit to Kiel
Determination of extraterrestial magnitudes from selected fix stars based on two-star measurements at Ny-Aalesund	G.V. Menzhylin, SpbGU A. Herber/U. Leiterer, Observatory Lindenberg	Julia Strelchenko	- Program submitted - Visit to Potsdam/Lindenberg

5. Anerkennung des Studiengangs in Deutschland

Der Senator
für Bildung und Wissenschaft

Freie
Hansestadt
Bremen

Der Senator für Bildung und Wissenschaft
Katharinenstr. 12-14 · 28195 Bremen

An den Rektor der Universität Bremen
Herrn Prof. Dr. W. Müller
Bibliothekstraße
28359 Bremen

Auskunft erteilt
Evelyn Oeljen
Zimmer 213
Tel. 0421 361-10748
Fax 0421 361-2742
E-mail
Evelyn.Oeljen@wissenschaft.bremen.de

Datum und Zeichen Ihres Schreibens

Mein Zeichen (bitte bei Antwort angeben)
GenehmigungPOMOR.doc

Bremen, den 29.4.2004

Masterstudiengang „M.Sc. Applied Polar and Marine Sciences" (POMOR)
Ihr Schreiben vom 23. 3. 2004, bei mir eingegangen am 26. 4. 2004

Sehr geehrter Herr Professor Müller,

mit og. Schreiben beantragt die Universität Bremen meine Zustimmung zur Einrichtung des Masterstudiengangs „M. Sc. Applied Polar and Marine Sciences" (POMOR) zum Sommersemester 2004 sowie die Genehmigung der dort beigefügten Prüfungsordnung.

Ich stimme hiermit der befristeten Einrichtung des og. Studiengangs für einen Durchlauf gemäß § 64a des Bremischen Hochschulgesetzes (BremHG) in der Fassung der Bekanntmachung vom 11. 7. 2003 (Brem.GBl. S. 295) zu.

Gemäß § 110 Abs. 1 Ziff. 5 BremHG genehmige ich gleichzeitig die Prüfungsordnung in der vom Akademischen Senat am 21. 4. 2004 beschlossenen Fassung.

Beide Genehmigungen werden befristet bis 30. 9. 2004 erteilt.

Ich möchte bereits jetzt darauf hinweisen, dass ich für den Fall, dass der Studiengang weitergeführt werden soll, die Prüfungsordnung einer intensiveren Prüfung unterziehen muss. Insofern bitte ich um rechtzeitige Übersendung der entsprechenden Unterlagen.

Mit freundlichen Grüßen

I. A.
(Dr. H. Bienhold)

UNIVERSITÄT BREMEN

Sachgebiet Lehre und Studium

- 130 -

Tel. (0421) 218-27 71
Telefax (0421) 218-4414
e-mail: msabass@uni-bremen.de

07-04-2004

Vorlage Nr. XX / für die XX / 7. Sitzung des Akademischen Senats am 21.04.2004

Zur Beschlußfassung

Betr.: Befristete Einrichtung eines Masterstudiengangs 'M.Sc. Applied Polar and Marine Sciences' (POMOR) im Fachbereich 5 zum Sommersemester 2004

Der Akademische Senat beschließt:

Der Akademische Senat beschließt die Einrichtung eines Masterstudiengangs 'M.Sc. Applied Polar and Marine Sciences' (POMOR) im Fachbereich 5 zum Sommersemester 2004. Die Einrichtung ist befristet bis 30.September 2004.

Der Fachbereich 5 wird aufgefordert, dem Akademischen Senat im Juni 2004 zu berichten, ob und auf der Grundlage welcher Kooperationen und Finanzierung der Studiengang ab Wintersemester 2004/05 weitergeführt werden kann und soll. Gegebenenfalls ist ein Antrag auf Verlängerung der Einrichtung zu stellen.

Begründung:

Im April 1998 haben die Universität Bremen und die Staatliche Universität St. Petersburg in einem Kooperationsvertrag u.a. vereinbart, dass ein Austausch von Studierenden und Lehrenden erfolgen soll (Anlage 1).

Der Verbund Norddeutscher Universitäten - hier insbesondere die Universitäten Bremen, Hamburg und Kiel - haben gemeinsam mit dem Alfred Wegener Institut Bremerhaven ihre Beteiligung an dem Studiengang POMOR zugesagt; Gegenstand der Vereinbarung ist auch, dass die Studierenden mindestens ein Semester an einer Universität oder in einem Forschungsinstitut in Deutschland studieren und den Titel 'Master of Science' einer deutschen Universität erhalten. Federführend ist dabei die Universität Bremen.

Der Masterstudiengang wurde zum WS 02/03 an der Universität St. Petersburg eingerichtet. Die Finanzierung der Kosten für Reisen der Lehrenden und Studierenden, Verwaltung etc. wurden bis Ende WS 03/04 wesentlich auch vom DAAD getragen. Die Anschlussfinanzierung durch den DAAD ist jedoch ungesichert, und ohne diese Unterstützung können die beteiligten Universitäten und Forschungsinstitute die Kosten für den Studiengang voraussichtlich nicht aufbringen. Die Suche nach alternativen Lösungen ist noch nicht abgeschlossen - für den Abschluss des Studiums der ersten Kohorte haben die Universitäten Bremen, Kiel und Hamburg jeweils 10.000 € über bereits vorhandene Eigenmittel (im wesentlichen Personal) hinaus zugesagt.

Anlage 2 ist ein Auszug aus dem Antrag auf Anschlussförderung beim DAAD, der auch die wesentlichen Informationen über die bisherige Durchführung des Studiengangs und die Beteiligungen enthält.

Die Studierenden der ersten Kohorte absolvieren im kommenden Sommersemester ihr 4. Semester an der Universität Bremen und im AWI, das mit der Abschlussarbeit und Disputation über die Arbeit endet. Curriculum und Prüfungsordnung sind so mit der Universität in St. Petersburg abgestimmt, dass

Wissenschaftler/innen der Universität Bremen maßgeblich an der Ausbildung und den Prüfungen beteiligt sind.

Der Fachbereichsrat 5 hat im März dieses Jahres der Einrichtung zugestimmt.

gez. Sabass

Anlagen:

1. Kooperationsvertrag zwischen der Universität Bremen und der Staatlichen Universität St. Petersburg
2. Auszug aus dem Anschlussantrag an den DAAD zur Förderung des Studiengangs
3. Prüfungsordnung und Studienplan
4. Antrag des Dekans des FB 5 und FBR-Beschluss

Akademischer Senat der Universität Bremen
XX/ 7.Sitzung, 21.04.2004

Beschluss Nr. 7974

Einrichtung des Studienganges M.Sc. Applied Polar and Marine Sciences (POMOR) im FB 5

Bezug: Vorlage Nr. XX/72

Der Akademische Senat beschließt die Einrichtung eines Masterstudiengangs 'M.Sc. Applied Polar and Marine Sciences' (POMOR) im Fachbereich 5 zum Sommersemester 2004. Die Einrichtung ist befristet bis 30.September 2004.

Der Fachbereich 5 wird aufgefordert, dem Akademischen Senat im Juni 2004 zu berichten, ob und auf der Grundlage welcher Kooperationen und Finanzierung der Studiengang ab Wintersemester 2004/05 weitergeführt werden kann und soll. Gegebenenfalls ist ein Antrag auf Verlängerung der Einrichtung zu stellen

Abstimmungsergebnis: einstimmig

POMOR Anlage 3

Der Rektor der Universität Bremen hat am 21.4.2004 nach § 110 Abs. 1. Nr. 5 des Bremischen Hochschulgesetzes in der Fassung der Bekanntmachung vom 11. Juli 2003 (Brem.GBl. S. 295 - 334 die fachspezifische Prüfungsordnung für den Master-Studiengang "Applied Polar and Marine Sciences" unter Bezug auf den Allgemeinen Teil für Master-Prüfungsordnungen der Universität Bremen in der nachstehenden Fassung genehmigt:

Prüfungsordnung für den Master-Studiengang Applied Polar and Marine Sciences der Universität Bremen vom 21.4.2004

Diese fachspezifische Prüfungsordnung gilt zusammen mit dem Allgemeinen Teil für Master-Prüfungsordnungen vom ..... . Sie ist abgestimmt mit den Staatlichen Standard-regelungen für den Masterstudiengang Hydrometeorologie an Universitäten der Russischen Föderation.

§ 1 Zulassungsvoraussetzungen zum Studium

(1) Die Zulassung zum Studium ist nur für Studienbewerber mit einem Bachelorabschluss oder einem Äquivalent in einer naturwissenschafltichen Disziplin möglich.

(2) Die weiteren Voraussetzungen und das Verfahren zur Zulassung zum Studium werden in einer Zulassungsordnung geregelt.

§ 2 Studiendauer, Studienaufbau und Stundenumfang

(1) Die Regelstudienzeit beträgt einschließlich der Bearbeitungszeit für die Masterarbeit vier Semester.

(2) Das Studium ist modular aufgebaut. Die Lehrveranstaltungen sind gem. Anhang 1 zu Modulbereichen zusammengefasst, die in der Regel jeweils 12 Semesterwochenstunden umfassen. Das Lehrveranstaltungsangebot umfasst insgesamt 6 Pflicht-Modulbereiche, die in den ersten drei Semestern absolviert werden müssen. Dazu kommen 24 Semesterwochenstunden allgemeine Veranstaltungen (Deutsch, Englisch, Methodik wissenschaftlichen Arbeitens). Im vierten Semester wird die Masterarbeit angefertigt und in einem Kolloquium verteidigt. Anschliessend folgt die mündliche Masterprüfung.

(3) Die prüfungsrelevanten Inhalte der Modulbereiche sind im Anhang 1 aufgeführt. Die zu erbringenden Studienleistungen entsprechen 90 Kreditpunkten nach dem European Credit Transfer System (ECTS), dazu kommen noch 15 Kreditpunkte für die allgemeinen Veranstaltungen und 30 Kreditpunkte für die Masterarbeit. Die Kreditpunkte der einzelnen Veranstaltungen werden im Rahmen der jährlichen Veranstaltungsplanung festgelegt.

(4) Die Lehrveranstaltungen werden in englischer Sprache abgehalten.

§ 3 Studienberatung

(1) Die Zuständigkeit für eine Studienberatung sowie Termine und Form der Studienberatung regelt die Studienordnung.

§ 4 Studienbegleitende Prüfungen

(1) Mögliche Formen der studienbegleitenden Prüfungen können mündliche Prüfungen, Seminarvorträge, schriftliche Ausarbeitungen oder Klausuren sein.

(2) In mündlichen Prüfungen soll festgestellt werden, ob der Kandidat über ein dem Stand des Studiums entsprechendes Wissen verfügt. Der Kandidat soll nachweisen, dass er die Zusammenhänge des Prüfungsgebietes erkennt und spezielle Fragestellungen in diese Zusammenhänge einzuordnen vermag. Mündliche Prüfungen sind universitätsöffentlich, jedoch nicht die Beratung über die Bewertung. Auf Antrag des Kandidaten ist die Öffentlichkeit auszuschließen. Die wesentlichen Gegenstände und Ergebnisse der mündlichen Prüfung sind in einem Protokoll festzuhalten. Das Ergebnis ist dem Kandidaten im Anschluss an die mündliche Prüfung bekannt zu geben.

(3) In Seminarvorträgen soll der Kandidat nachweisen, dass er die wesentlichen Sachverhalte und Zusammenhänge des Vortragsthemas kennt, diese mündlich darstellen und in Diskussion mit den Teilnehmern erläutern, vertiefen und verteidigen kann.

(4) In Klausurarbeiten und schriftlichen Ausarbeitungen soll der Kandidat nachweisen, dass er auf Basis des vermittelten Stoffes in begrenzter Zeit mit den gängigen Methoden seines Faches Aufgaben lösen und Themen bearbeiten kann. Die Dauer der Klausurarbeiten beträgt mindestens 60 Minuten und höchstens drei Stunden.

(5) Formen und Zeiten für die Erbringung von Prüfungen werden von den Veranstaltern zu Beginn der Veranstaltung mitgeteilt.

(6) Die verbindliche Anmeldung zu einer Prüfung erfolgt spätestens vier Wochen nach Beginn der Veranstaltung.

§ 5 Masterprüfung

(1) Die Masterprüfung setzt sich aus folgenden Prüfungsleistungen zusammen:
a) Studienbegleitende Prüfungen gem. § 4
b) Masterarbeit gem. § 9 Abs. 1 bis 4
c) Kolloquium über die Masterarbeit gem § 9 Abs. 5 und 6
d) Mündliche Masterprüfung gem § 9 Abs. 7 und 8

(2) Die Prüfungssprache ist englisch.

§ 6 Anrechnung von Studien- und Prüfungsleistungen

(1) Studien- und Prüfungsleistungen, die an anderen Hochschulen erbracht wurden, können auf der Grundlage von Kooperationsvereinbarungen mit Partner-Hochschulen anerkannt

werden.

(2) Über die Anerkennung dieser Studien- und Prüfungsleistungen entscheidet der Prüfungsausschuss.

§ 7 Zulassungsvoraussetzungen für die Masterprüfung

(1) Die Zulassung zur Masterprüfung wird in der Regel bis zum Ende des dritten Studiensemesters beantragt. Sie kann nach erfolgreichem Abschluss der Modulbereiche innerhalb einer Frist von einem Monat beim Prüfungsausschuss beantragt werden.

(2) Dem Antrag auf Zulassung zur Masterprüfung sind beizufügen:
1. Nachweise über die bestandenen Prüfungen in den Modulbereichen
2. Themenstellung und Namen der Betreuer der Masterarbeit

(3) Kann ein Kandidat keine Betreuer für eine Masterarbeit finden, so regelt der Vorsitzende des Prüfungsausschuss eine entsprechende Betreuung.

§ 8 Prüfungsanforderungen der Masterprüfung

(1) Die Masterprüfung ist bestanden, wenn alle Prüfungen gem. § 5 Abs. 1 bestanden sind.

(2) In den ersten drei Semestern sind pflichtgemäss konsekutiv alle 6 Modulbereiche (pro Semester jeweils zwei Modulbereiche) gemäß Anhang zu belegen und insgesamt 90 Credits zu erwerben. Dazu kommen Nachweise aus Veranstaltungen des Allgemeinen Teils mit insgesamt 15 Credits.

Modulbereiche

1	Ocean Basins, Morphology, and Sediments
2	The High Seas and Coastal Water Oceanography
3	Ecosystem Structure and Functioning
4	Non-living Resources: Exploration and Exploitation
5	Costal Zones: Processes and Management
6	Periglacial Systems

Die Modulbereiche sind im Anhang aufgeführt.

(3) Inhalt und Umfang der Modulbereiche und die ihnen zugeordneten Leistungspunkte werden im Studienplan als Anhang zur Prüfungsordnung genannt.

§ 9 Masterarbeit und mündliche Prüfung

(1) Die Masterarbeit ist eine wissenschaftliche Arbeit, in der eine Fragestellung selbständig in einer vorgegebenen Frist bearbeitet wird. Sie soll zeigen, dass der Kandidat mit den wissenschaftlichen Methoden der Geowissenschaften vertraut ist und sie sinnvoll einzusetzen weiss.

(2) Die Masterarbeit wird in englisch abgefasst.

(3) Die Zulassung zur Masterarbeit wird in der Regel bis zum Ende des dritten Studiensemesters beantragt. Sie kann nach erfolgreichem Abschluss der Modulbereiche innerhalb einer Frist von einem Monat beim Prüfungsausschuss beantragt werden.

(4) Die Dauer der Abschlussarbeit beträgt 22 Wochen ab dem Datum der Zulassung. Im Einzelfall kann auf begründeten Antrag der Prüfungsausschuss die Bearbeitungszeit um höchstens 4 Wochen verlängern.

(5) Im Kolloquium soll der Kandidat nachweisen, dass er in einer Auseinandersetzung über den Themenbereich der Masterarbeit die erarbeiteten Lösungen selbständig fachübergreifend und problembezogen auf wissenschaftlicher Grundlage vertreten kann.

(6) Das Kolloquium soll spätestens 8 Wochen nach Abgabe der Arbeit stattfinden. Die Dauer des Kolloquiums beträgt maximal 45 Minuten.

(7) Die mündliche Prüfung soll feststellen, ob der Kandidat vertiefte wissenschaftliche Kenntnisse besitzt und spezielle Methoden entsprechend dem Stand der Forschung anzuwenden versteht. Die mündliche Prüfung erfolgt als Kollegialprüfung und dauert maximal 60 Minuten.

(8) Die mündliche Prüfung muss in der Regel bis zum Ende des vierten Semesters abgelegt sein.

§ 10 Gesamtnote der Masterprüfung

(1) Sind alle in § 4 genannten Prüfungsteile bestanden, wird eine Gesamtnote aus dem arithmetischen Mittel der Abschlussnoten der Modulbereiche, der Note der Masterarbeit und der Note der mündlichen Masterprüfung gebildet. Hierbei wird die gemittelte Note aus den Modulbereichen zu 50%, die Note der Masterarbeit zu 30% und die Note der mündlichen Masterprüfung und des Kolloquiums zu 20% gewichtet.

§ 11 Zeugnis und Urkunde

(1) Das Zeugnis über die bestandene Masterprüfung wird in deutscher und englischer Sprache ausgestellt. Es enthält den erworbenen Titel, alle Prüfungsergebnisse aus § 5 sowie die Gesamtnote gemäss § 10. Im Zeugnis wird auch das Thema der Masterarbeit aufgeführt. Bei allen Prüfungen und der Masterarbeit sind die jeweiligen Prüfer bzw. Gutachter anzugeben. Es wird ein Diploma Supplement ausgestellt.

(2) Gleichzeitig mit dem Zeugnis wird dem Kandidaten eine Urkunde in deutscher und englischer Sprache mit dem Datum des Zeugnisses ausgehändigt. Darin wird die Verleihung des Mastergrades beurkundet. Die Urkunde wird vom Dekan des Fachbereichs und dem Vorsitzenden des Prüfungsausschusses unterzeichnet und mit dem Siegel der Universität Bremen versehen.

§ 12 Mastergrad

Augrund der bestandenen Masterprüfung verleiht die Universität den akademischen Grad "Master of Science" (abgekürzt "M.Sc.").

§ 13 Geltungsbereich und Inkrafttreten

(1) Diese Masterprüfungsordnung tritt mit Wirkung vom XX.XX. 2004 in Kraft.

(2) Sie gilt erstmals für die Studierenden, die im WS 2002/2003 ihr Studium in diesem Masterstudiengang aufgenommen haben.

Studienplan

Alle 6 Modulbereiche sind Pflicht und folgen konsekutiv in 3 Semestern aufeinander. Sie umfassen Module bzw. Lehrveranstaltungen von je 12 SWS entsprechend einer Gesamtpunktzahl von 90 ECTS. Dazu kommen 24 Semesterwochenstunden allgemeine Veranstaltungen (Deutsch, Englisch, Methodik wissenschaftlichen Arbeitens). Im vierten Semester wird die Masterarbeit angefertigt und in einem Kolloquium verteidigt. Anschliessend folgt die mündliche Masterprüfung.

1. Semester

Modulbereich 1: Ocean Basins, Morphology and Sediments (Bickert, Zhirov)
12 SWS 15 ECTS Lehrangebot: Univ. St. Petersburg, Univ. Bremen

- Ocean basin morphology, tectonic construction and dynamics
- Methods of ocean floor mapping
- Marine sediments and climate history
- Regional marine geology
- Geosciences of polar regions
- Methods in marine geosciences
- Marine geotechnology

Modulbereich 2: The High Seas and Coastal Waters Oceanography (Rhein, Ionov)
12 SWS 15 ECTS Lehrangebot: Univ. St. Petersburg, Univ. Bremen

- Introduction to Fluid Dynamics
- Geophysical applications of fluid dynamics
- Introduction to physical oceanography
- Ocean waves
- Coastal ocean dynamics
- Turbulence
- Dynamic oceanography
- Physics of the air-sea boundary layer
- Ocean measurements and ocean data analysis
- Advanced general oceanography

2. Semester

Modulbereich 3: Ecosystem: structure and functioning (Movchan, Dmitriev, Tuschling)
12 SWS 15 ECTS Lehrangebot: Univ. St. Petersburg, Univ. Bremen, Kiel, Rostock

- Introduction to ecology
- Methods of ecological investigations
- Marine subsystems
- Ecology of terrestrial regions
- Exchange between environmental systems
- Susceptibility of polar systems

Modulbereich 4: Non living resources: Exploration and Exploitation: Hydrocarbons, Soils, Rocks and Minerals (Zhirov, Troyan, Dullo, Reijmer)
12 SWS 15 ECTS Lehrangebot: Univ. St. Petersburg, Univ. Kiel

- Land and Leasing
- Economics and Risk assessment
- Wellsite methods
- Production and Engineering
- Reservoir Engineering methods
- Wireline methods
- Geological methods
- Marine geophysical method
- Submarine hydrothermal systems
- Processing and analyses of geophysical data

3. Semester

Modulbereich 5: Coastal Zones: Processes and Managament (Donchenko, Harff, Klenke)
12 SWS 15 ECTS Lehrangebot: Univ. St. Petersburg, Univ. Hamburg, Potsdam

- Land-Ocean Interaction
- Socio-Economics of the Coastal Zone
- Marine Environment Protection Law
- Integrated Coastal Zone Management
- Coastal Zone Engineering
- Data Management, Modelling and Forecasting
- Applications and case studies in polar regions

Modulbereich 6: Periglacial Systems (Kassens, Vuglinsky)
12 SWS 15 ECTS Lehrangebot: Univ. St. Petersburg, Univ. Kiel, Rostock

- The Periglacial Environment
- Present-day Periglacial Environments
- Water resources and hydrological aspects
- Microbiology and Biogeochemical Cycles in Arctic Environments
- Geotechnical and engineering aspects of periglacial environments
- Global change and perigiacial environments
- Excursion

1. bis 3. Semester, zusätzlich

Modulbereich 0: Common block		
3 x 8 SWS	15 ECTS	Lehrangebot: Univ. St. Petersburg, Univ. Bremen, Kiel

- English
- German
- History and methodology in Science
- Scientific presentation

4. Semester

Masterarbeit		
22 Wochen	30 ECTS	Betreung: je ein russischer und ein deutscher Dozent

POMOR-Master Examination

Module 1: Ocean Basins, morphology and sediments:

1. Describe methods for reconstruction of paleo-surface-water-temperatures from marine sediments.
2. When did the major Cenozoic glaciations start in the Northern (Arctic) and Southern Hemispheres (Antarctica)? What factors did cause the onset of these glaciations?
3. What are the characteristics of the Late Cretaceous Arctic Ocean?
4. Explain the magnetic field of the Earth e.g:. The external and internal components of the geomagnetic field, normal and anomalous fields, paleomagnetism, inversions of the magnetic field, paleomagnetic epochs and episodes, paleomagnetic (Lamont´s) skale, residual magnetism of rocks and Curie point (temperature), linear magnetic anomalies of the ocean floor, hypothesis of Vine and Mathews, seismicity of the lithosphere within the World ocean.
5. Explain the types of the main seismogenetic belts and the focal mechanisms of earthquakes e.g.: Depths of the hypocenters of earthquakes within main elements of the relief of the World ocean floor, Benjoff zones (seism focal zones)
6. Explain the magmatism within the World Ocean e.g.: hydrothermal activity within the main elements of the relief of World ocean floor, basalts of deep-water ocean floor (of the second ocean layer), their ages, Tholejite series, Basalts of mid-ocean ridges, Magmatism of island arc systems.

Module 2: High seas and coastal waters oceanography

1. What causes the principal open ocean surface currents?
2. Explain Ekman transport and its role in upwelling.
3. Which forces are in balance for a geostrophic flow?
4. What kind of specific waves occur at the coastal zones?
5. What are the main peculiarities of ocean-atmosphere heat interaction in the Arctic Basin?
6. What is the role of the Southern Ocean and Antarctic Circumpolar Current in climate related processes?

Module 3. Ecosystems: structure and functioning

1. Describe the pelagic food web. Name some organisms or groups of organisms representing groups in the marine plankton (from micrometer scale to decimeter size). Include some characteristic biological features (e.g. taxonomy, physiology, behavior, adaptation) for each of the groups named.
2. Describe the effects of a settling spring bloom on the benthic community. Which planktonic organisms produce skeletal materials that contribute to sediments on the seafloor?
3. Which processes are described by the measurement of the sediment oxygen demand (SOD) and which metabolic processes have no direct or indirect effect on oxygen consumption?
4. Describe the living conditions in and role of sea ice for organisms (bacteria – krill- polar bear).

5. Describe the methods and means of ecological standartization and land use regulation
6. Describe the accumulation of toxic substances (including radionuclides) in the Arctic food chain (Dose-effect relation)

Module 4: Non-living resources

1. Oil and gas exploration depends on many circumstances and eventualities. Industry therefore developed a "play concept". Please explain it and discuss constraints.
2. What characterizes a potential source rock and a potential host rock?
3. Why is the gamma ray log a good indicator for clay content? Why should I use spectral gamma ray when working in carbonates?
4. Describe the Oil and gas provinces and prospective oil and gas provinces of the Arctic ocean and it's continental surroundings.
5. Describe the sedimentary basins of the Arctic geodynamical system and their ages.
6. Decribe the history of starting and of development of the marine oil and gas industry.

Module 5: Coastal systems: processes and management

1. Describe transport and transformation of material in the coastal environment.
2. Describe the basic groups of pollutants for the coastal environment and their sources, monitoring strategies and analytical methods for their determination.
3. Which laws do rule the exploitation of the resources of the marine coastal zone and the protection of its environment?
4. What is Integrated Coastal Zone Management and describe strategies in coastal zone engineering?
5. Explain the concept and general principals of sustainable development on global, regional and local Agenda 21 scale. Describe the main successes and obstacles for the transition to a sustainable development.
6. Ecological safety of coastal zones: methods of an estimation and management of risk of natural environment pollution.

Module 6: Polar systems

1. Give a definition of permafrost, permafrost table and active layer?
2. What are the limiting factors for agriculture in permafrost affected soil?
3. What are possible impacts on permafrost under the prognosticated global warming?
4. What are the main techniques of engineering in permafrost regions?
5. Using stable isotopes, which information can be obtained when studying recent (rain, snow) and past (glaciers, ground ice) precipitation?
6. Explain the foramtion of lakes and swamps in permafrost regions and the processes in thermokarst regions and typical landforms

6. Zeugnisse (mit Zustimmung der Absolventen)

UNIVERSITÄT BREMEN

Universität Bremen

in Kooperation mit der

Staatlichen Universität St. Petersburg

Fachbereich
Geowissenschaften
Prüfungsausschuss
Geowissenschaften

Master

Frau Olga PREOBRAZHENSKAYA

geboren am 04.12.1980 in Leningrad

hat am 30. September 2004

die Master-Prüfung gemäß der Prüfungsordnung der Universität Bremen für den Studiengang **Applied Polar and Marine Sciences** bestanden mit dem

Gesamturteil A U S G E Z E I C H N E T

Auf Grund dieser Prüfung wird ihr hiermit der akademische Grad

Master of Science
in
Applied Polar and Marine Sciences

verliehen.

Bremen, den 27. Oktober 2004

Universität Bremen 63

Der Dekan des Fachbereiches

Prof. Dr. R. Henrich

Der Vorsitzende des Prüfungsausschusses

Prof. Dr. K.-U. Hinrichs

Universität Bremen

in Kooperation mit der

Staatlichen Universität St. Petersburg

Fachbereich
Geowissenschaften

Prüfungsausschuss
Geowissenschaften

Zeugnis der Masterprüfung

Frau Olga PREOBRAZHENSKAYA

geboren am 04.12.1980 in Leningrad

hat sich gemäß der Prüfungsordnung der Universität Bremen vom 29.04.2004 für den Master-Studiengang **Applied and Polar Marine Sciences** der Master-Prüfung unterzogen und folgende Beurteilung erhalten:

1. Studienjahr

Modul	Note	ECTS-Pkte
Ocean Basins, Morphology, and Sediments	ausgezeichnet	15
High Seas and Coastal Water Oceanography	ausgezeichnet	15
Ecosystem: Structure and functioning	ausgezeichnet	15
Non-living resources	ausgezeichnet	15

2. Studienjahr

Modul	Note	ECTS-Pkte
Coastal Zones: Processes and Management	ausgezeichnet	15
Periglacial Systems	ausgezeichnet	15
Master Prüfung		
Mündliche Prüfung	ausgezeichnet	20
Verteidigung der Masterarbeit	ausgezeichnet	20

Masterarbeit

Thema der Masterarbeit:

Studies on the sympagic meiofauna in Arctic first-year pack ice

Gutachter: Dr. Iris Werner, Kiel; Prof. Dr. Gennady Belozerskiy, St. Petersburg

Die Masterarbeit wurde mit - ausgezeichnet (1.0) - beurteilt.

Nach diesen Ergebnissen ist die Masterprüfung mit dem Gesamturteil

AUSGEZEICHNET (1.0)

bestanden worden.

Bremen, den 27. Oktober 2004

Universität Bremen 63

Der Vorsitzende des
Prüfungsausschusses

Prof. Dr. K.-U. Hinrichs

Übersetzungsschlüssel: *(equivalence of grades)*	Deutsche Note (German grade)	ECTS-Grade/ Definition
	1.0 – 1.2 / ausgezeichnet	excellent
	1.3 – 1.5 / *sehr gut*	*very good*
	1.6 – 2.5 / gut	good
	2.6 – 3.5 / befriedigend	satisfactory
	3.6 – 4.0 / ausreichend	sufficient
	4.1 – 5.0 / nicht ausreichend	fail

Universität Bremen

in Cooperation with

State University St. Petersburg

Faculty of
Geosciences
Examination Board
of Geosciences

Master

Miss Olga PREOBRAZHENSKAYA

born 04.12.1980 in Leningrad

passed at 30. September 2004

the Master exam according to all requirements of the University of Bremen for the Master study program **Applied Polar and Marine Sciences** with the grade

EXCELLENT

She has this day been admitted to the degree of

Master of Science
in
Applied Polar and Marine Sciences

Bremen, 27. Oktober 2004

Universität Bremen

Dean of the
Faculty

Prof. Dr. R. Henrich

Head of the
Examination Board

Prof. Dr. K.-U. Hinrichs

Universität Bremen

in Cooperation with the

State University St. Petersburg

Faculty of Geosciences

Examination Board of Geosciences

Certification of Master Exam

Miss Olga PREOBRAZHENSKAYA

born 04.12.1980 in Leningrad

has fullfilled all requirements of the examination regulations of the University of Bremen dated 29.04.2004 for the master study program **Applied and Polar Marine Sciences** and obtained the following results:

1. Academic Year

Modul	Grade	Credits
Ocean Basins, Morphology, and Sediments	excellent	15
High Seas and Coastal Water Oceanography	excellent	15
Ecosystem: Structure and functioning	excellent	15
Non-living resources	excellent	15

2. Academic Year

Modul	Grade	Credits
Coastal Zones: Processes and Management	excellent	15
Periglacial Systems	excellent	15
Master Exams		
Oral Exam	excellent	20
Defense of Thesis	excellent	20

Master thesis

Theme of the thesis:

Studies on the sympagic meiofauna in Arctic first-year pack ice

Supervisors: Dr. Iris Werner, Kiel; Prof. Dr. Gennady Belozerskiy, St. Petersburg

The master thesis has been rated to be - excellent (1.0) - .

According to the obtained results, the master exam has been rated to be

EXCELLENT (1.0)

Bremen, den 27. October 2004

Head of the
Examination Board

Prof. Dr. K.-U. Hinrichs

Übersetzungsschlüssel: *(equivalence of grades)*	Deutsche Note (German grade)	ECTS-Grade/ Definition
	1.0 – 1.2 / ausgezeichnet	excellent
	1.3 – 1.5 / sehr gut	very good
	1.6 – 2.5 / gut	good
	2.6 – 3.5 / befriedigend	satisfactory
	3.6 – 4.0 / ausreichend	sufficient
	4.1 – 5.0 / nicht ausreichend	fail

Universität Bremen

DER REKTOR

Prof. Dr.
Wilfried Müller

Telefon (0421) 218 – 27 08
Fax (0421) 218 – 42 59
eMail rektor@uni-bremen.de

Liebe Absolventin, lieber Absolvent,

ich möchte Sie herzlich zu Ihrem erfolgreichen Studienabschluss an der Universität Bremen beglückwünschen. Nach der Anstrengung des Lernens für die Prüfungen und des Schreibens an der Abschlussarbeit halten Sie nun mit der Urkunde den Lohn ihrer Mühen in Händen. Ich hoffe, dass Sie auf Ihre Studienzeit mit insgesamt positiven Gefühlen zurückblicken und wünsche Ihnen viel Erfolg beim Start in das Berufsleben oder auf dem Weg zu einer wissenschaftlichen Laufbahn.

Auch die Universität erfüllt es mit Stolz, dass Sie als Absolventin und als Absolvent ihre Studienziele verwirklicht haben, denn Ihre Zufriedenheit und Ihr Erfolg bestätigt die Qualität unserer Lehrangebote. Daher ist uns auch daran gelegen, dass nun nach diesem vollendeten Abschnitt Ihrer akademischen Ausbildung der Kontakt zur Universität nicht ganz abbricht. Wir möchten mit Ihnen in Verbindung bleiben, Sie über die weitere Entwicklung Ihrer Ausbildungsstätte Universität informieren und nach einiger Zeit auch etwas über Ihren anschließenden Werdegang nach dem Studium erfahren.

Die Möglichkeit, den Kontakt zwischen Ihnen und der Universität zu bewahren, bietet das zentrale Alumni-Netzwerk der Universität Bremen. Denn wir rechnen jeden, der einen akademischen Grad unserer Universität erworben hat, zu unseren „Alumni“ (so ist die Bezeichnung für Absolventinnen und Absolventen an angloamerikanischen Hochschulen und inzwischen auch international gebräuchlich). Sie können in der kleinen Alumni-Broschüre, die jeder zu seinem Abschluss erhält, mehr über die Ziele erfahren und welche nützlichen Gelegenheiten Ihnen offen stehen. Wenn Sie sich in das Alumni-Verzeichnis eintragen und Ihre Adresse dort hinterlassen, bleiben Sie Teil der community bremen. Denn das möchten wir gern erreichen: dass Sich sich auch in Zukunft gern der Universität zugehörig fühlen. Ich möchte Sie ausdrücklich dazu ermuntern, dem Alumni-Netzwerk rechtzeitig beizutreten.

Ich wünsche mir, dass die Universität Bremen Ihnen etwas mitgegeben hat, wodurch sie nun mit Stolz als unsere „Botschafter“ in der Welt auftreten können. Die Universität wird alles tun, um diese Motivation zu stärken.

Mit freundlichen Grüßen
Ihr

Prof. Dr. Wilfried Müller
Rektor der Universität Bremen

РОССИЙСКАЯ ФЕДЕРАЦИЯ

Фамилия, имя, отчество

Колдунов Николай Владимирович

Дата рождения **28 марта 1981 года**

Предыдущий документ об образовании

диплом бакалавра по направлению Гидрометеорология, выданный в 2002 году

Вступительные испытания прошел

Поступил(а) в 2002 году в Санкт-Петербургский государственный университет (очная форма)

Завершил(а) обучение в 2004 году в Санкт-Петербургском государственном университете (очная форма)

г. Санкт-Петербург
Санкт-Петербургский государственный университет

ПРИЛОЖЕНИЕ К ДИПЛОМУ

с отличием

№ АВМ 0086597

2440
(регистрационный номер)

18 июня 2004 года
(дата выдачи)

Нормативный период обучения по очной форме 6 лет

Направление/специальность Гидрометеорология

Специализация Полярные и морские исследования

Курсовые работы:

не предусмотрено

Решением Государственной аттестационной комиссии

от 15 июня 2004 года

присуждена СТЕПЕНЬ МАГИСТРА ГИДРОМЕТЕОРОЛОГИИ по направлению «Гидрометеорология»

Практика:

научно-исследовательская, 19 недель, зачтено

научно- педагогическая, 2 недели, зачтено

Итоговые государственные экзамены:

итоговый междисциплинарный экзамен по направлению, отлично

Выполнение и защита выпускной квалификационной работы

на тему:« Изменчивость температуры и солености в перемешанном слое Восточно-Сибирского моря и моря Лаптевых», 18 недель , отлично

Данный диплом дает право профессиональной деятельности в соответствии с уровнем образования и квалификацией.

Ректор

Декан

Секретарь

М. П.

Продолжение см. на обороте

Документ содержит количество листов:

За время обучения сдал(а) зачеты, промежуточные и итоговые экзамены по следующим дисциплинам:

Наименование дисциплин	*Общее количество часов*	*Итоговая оценка*
1. Английский язык	368	отлично
2. История и методология науки	156	зачтено
3. Компьютерные и ГИС технологии в гидрометеорологии	110	зачтено
4. Наука и общество	110	зачтено
5. Практикум по подготовке научных сообщений	78	зачтено
6. Представление докладов в науке	78	зачтено
7. Введение в физическую океанографию	63	зачтено
8. Динамическая океанография	63	хорошо
9. Океанография прибрежных вод	78	зачтено
10. Океанические бассейны: морфология, тектоническое строение и динамика	63	отлично
11. Геологическая история и морские отложения	63	отлично
12. Геоисследования полярных стран	64	зачтено
13. Экологическая оценка и лизинг земель	64	отлично
14. Геофизические методы и методы частотной разведки	50	зачтено
15. Разведочно-поисковые и геологические методы	78	зачтено
16. Биоэкологические и геоэкологические проблемы северных территорий	64	отлично
17. Глобальные экологические проблемы, связанные с Арктикой	50	отлично
18. Геоэкология и проблемы природопользования арктического шельфа	64	отлично
19. Гляциология	50	зачтено
20. Геокриология	64	отлично
21. Методы перегляциальных исследований	50	зачтено
22. Взаимодействие суши и океана	64	отлично
23. Менеджмент береговых зон	64	отлично
24. Экологически безопасное устойчивое социо-природное развитие прибрежных зон	78	зачтено
Дисциплины, изученные за предшествующие 4 года, указаны в приложении к диплому бакалавра по направлению Гидрометеорология, выданном в 2002 году		
Всего	2034	
в том числе аудиторных	784	

Конец документа

7. Veröffentlichungen und Öffentlichkeitsarbeit

В последнее время PR все чаще используется для информирования населения о разных видах общественной деятельности. Если на заре PR-кампаний этот термин был для многих непонятен, то сейчас его смысл проник в сознание простых граждан, не связанных с пиаром. Фактически произошел мощный прогресс PR, и это связано не только с его развитием как понятия, но и как рода деятельности. Немалую роль в этом сыграли СМИ, в частности, журнал «PR-диалог».

Первые номера малотиражного журнала выходили в свет черно-белыми и были сравнительно небольшого объема — порядка 50 страниц. Но по мере востребования информации о PR-сфере и ее развитии «PR-диалог» стал «расти» и «созревать». За 5 лет он «вырос» до 92 страниц. Уважение читателей к журналу вызывает факт его «прямого курса». Приятно отметить, что основные принципы журнала за этот срок не изменились.

За 5 журнальных лет «PR-диалог» обрел круг верных читателей. Среди них и студенты, и преподаватели, и политики, и бизнесмены, и многие, многие другие, интересующиеся PR'ом. Заметьте: за все годы существования журнал сохранил основные принципы журналистики — достоверность, объективность, гуманность, а это, согласитесь, серьезный факт.

Роман ЗАВРАЖНОВ, студент 1 курса СПбГЭТУ

М.А.Шишкина принимает поздравления.

Круглый стол

Тринадцатого ноября на геологическом факультете прошло заседание круглого стола под названием «Наука о земле». Российско-германский комитет обсуждал проблемы науки о земле на базе совместных исследований. Круглый стол проводится два раза в год — по разу в России и Германии. Участвовали представитель федерального министерства образования и исследования ФРГ, представитель Минпромнауки, ученые из Потсдама, Бонна и Берлина.

Какие же именно вопросы обсуждались на собрании? Отвечает проректор по научной работе В.Н.ТРОЯН:

«Из самых важных хочу отметить проект глубинного бурения. Это очень важно для России — скважины будут бурить в Сибири. Мы узнаем много нового о строении земной коры, это поможет в поиске полезных ископаемых.

Также мы обсудили продолжение совместных работ по исследованию моря Лаптевых. Мы изучаем климатические изменения, основные параметры, связанные с флорой и фауной моря, исследуем шельф с целью поиска полезных ископаемых.

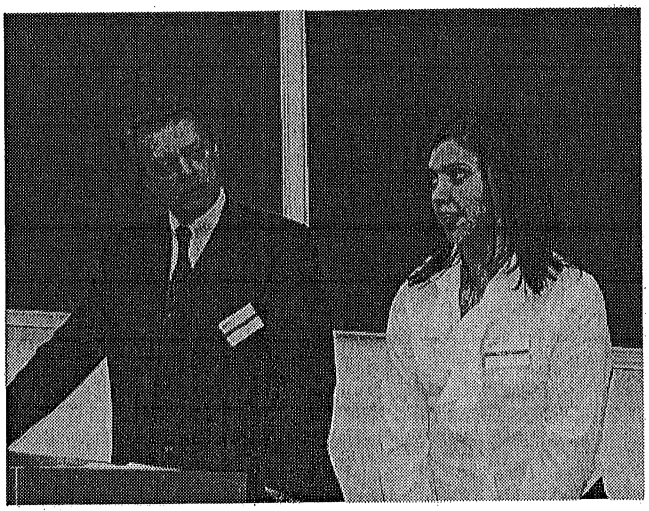
Мы планируем совместные программы по изучению мирового климата с использованием космических спутников. Анализируем процессы, протекающие в атмосфере, пытаемся прогнозировать изменения климата на пять-десять лет вперед.

И еще существует совместный проект, позволяющий разрабатывать новые компьютерные алгоритмы и программы для анализа и обработки данных с целью поиска полезных ископаемых и предупреждения стихийных бедствий (землетрясений, извержений вулканов и т.п.). В этом проекте участвуют СПбГУ, Академия наук РФ, Постдамский исследовательский центр по наукам о земле, Гамбургский университет и Свободный университет Берлина».

Антон ЗНАМЕНСКИЙ

Студенческое слово в российско-германском диалоге

С сентября 2002 года на факультете географии и геоэкологии СПбГУ началась подготовка магистров по программе «Полярные и морские исследования» — отсюда и ее название «Помор». Программа реализуется совместно с шестью университетами и научными институтами Германии. Лекции ведутся русскими и немецкими преподавателями, поэтому студентам необходимо хорошее знание английского языка — именно на нем немцы читают свои лекции. Прием студентов ведется на конкурсной основе, учиться в ней могут студенты не только СПбГУ, но и других российских и зарубежных вузов. Магистерская программа организована по направлениям «Гидрометеорология», «География», «География и картография» и «Экология и природопользование», а также студентов специальностей «Метеорология», «Гидрология», «Океанология», «География»,



«Экология» и «Прикладная математика (в картографии)». Студентам «Помора» целиком отдана 96 аудитория геофака, оснащение которой финансировалось грантом Германской академической обменной службой (DAAD).

Церемония открытия прошла 13 ноября; с приветственными речами выступили русские и немецкие гости торжества.

Декан факультета географии и геоэкологии В.В.ДМИТРИЕВ:

«Я очень рад, что этот день наступил. Не буду сегодня занимать ваше время, главное — открыть наше замечательное детище!»

Ректор СПбГУ Л.А.ВЕРБИЦКАЯ:

«Хочу выделить три обстоятельства. Во-первых, программа смогла начать свою жизнь с помощью университетов и исследовательских центров Германии. Во-вторых, очень важно, что в программе могут участвовать студенты не только СПбГУ, но и других вузов России. И в-третьих, программа открыта, подчеркиваю, на госбюджетной дневной основе обучения. Спасибо всем, кто сделал возможным этот день».

Генеральный консул ФРГ Ульрих ШЕННИНГ:

«Мы уже проводили совместные исследовательские экспедиции в моря Карское и Лаптевых. В Петербурге, в НИИ Арктики и Антарктики создана лаборатория имени Отто Юльевича Шмидта (открыта в июле прошлого года, 1 миллион марок на оснащение выделило тогда немецкое правительство. — *прим. ред.*). POMOR — это продолжение нашего сотрудничества. Наши научные связи стали еще теснее. Русские и немецкие студенты будут обучаться вместе, проводить совместные исследования с коллегами из других стран. Программа — это плод так называемого германо-российского диалога. Наше тесное сотрудничество можно даже вписать в планы глобализации. Я вижу только положительное в рождении нашего общего «ребенка». Я уверен, что будущее — в исследовании Мирового океана. Надеюсь, студенты подадут хороший пример политическому сотрудничеству России и Германии».

Руководитель германской академической обменной службы доктор Грегор БЕРГХОРН:

«Думаю, сегодняшнее событие достойно называться одной из значительных глав в сотрудничестве России и Германии. Российская Академия наук выпустила книгу о научном обмене Германии и России — ясно, как плотно контактируют наши страны, насколько уникальны отношения в области науки. Всем желаю успеха, и чтоб денег на науку всегда хватало!»

Представитель Федерального министерства образования и исследований ФРГ Р.ОЛИГ:

«Министр очень хотела приехать сама, но ей пришлось решать организационные вопросы в связи с близящимися выборами в Бундестаг. Последние десять лет мне довелось наблюдать развитие российско-германского сотрудничества. Оно пережило свою высшую точку, когда в Санкт-Петербурге была открыта лаборатория имени Отто Шмидта. Два года назад я уже посещал СПбГУ, и тогда я впервые услышал об идее создать студенческую программу. Я даже не мог мечтать, что когда я снова приеду в Санкт-Петербург, она уже начнет функционировать. Я думаю, исторически доказано, что лучший способ достичь высоких результатов — это сотрудничество. Наше министерство выделило десять миллионов евро на 29 проектов и программ, три из них в России, один — в СПбГУ. Это событие достойно быть упомянутым в политическом российско-германском диалоге. Огромное спасибо всем, кто поучаствовал в создании нашей программы, особенно ректору СПбГУ Л.А.Вербицкой».

Представитель Министерства промышленности, наук и технологий В.Н.ЖИВАГО:

«Событие важно не только для России, но и для всего океанологического сообщества. Министр тоже оказал боль-

лю поддержку и просил поздравить всех с началом проаммы. Я ознакомился с дисциплинами курса, и я уверен, что уденты будут чувствовать себя уютно и в аудиториях, и на лубах научно-исследовательских судов. Я работаю в орга- их федеральной власти и знаю, какое большое внимание еляется морским и полярным исследованиям. В 2000 году России была принята морская доктрина. Это морская по- тика нашей страны до 2020 года, и она выражается не лько в научных исследованиях в интересах Министерства ороны, но и в подготовке действительно хороших специа- стов в этих отраслях. Все это я рассказываю, чтобы вы няли, что в России очень большая нехватка профессиона- лов в этой области. Министр с очень большим интересом отнесся к проекту, и я надеюсь, что студенты найдут много интересного и в других российских и международных программах. Пожелаю вам, по старой морской традиции, попутного ветра и семь футов под килем!»

Всех приглашают поприсутствовать при открытии аудитории №96. Л.А.Вербицкая и Р.Олиг не разрезают ленточку — ждут студентов «Помора». Наконец, аудитория открыта, гости пишут в специальной книге свои теплые пожелания будущей программе.

Антон ЗНАМЕНСКИЙ

Необщее лицо не нашей общей эпохи

1.А.Мирзоянц

***В** понедельник, 18 ноября, в Актовом зале СПбГУ прошла конференция, посвященная 60-летию Сталинградской битвы. С сожалением отмечаешь, что етераны составили всего процентов пять от собравших- я. Жизнь... Если уж сама битва разменяла седьмой деся- ок, то что говорить о людях, в ней участвовавших? Пере- ена лиц заставила и журнал «СПбУ» в очередной раз адуматься о времени и о том, над чем оно не властно.*

«Воспоминания о войне» — так назывался вступитель- ый доклад доцента ФВО, полковника в отставке М.А.МИР- ОЯНЦА, уже единственного из состава нынешней конфе- енции, кто сам участвовал в Сталинградской битве. Михаил ркадьевич — один из многих (часто безымянных) строителей ого, что сейчас мы называем «наша история». Человек трех эпох, родившийся еще до революции, всю свою сознательную жизнь проживший в Советской России, теперь он живет в России новой. Итак, о времени и о себе.

— Мы, конечно, принадлежим совсем к другому поколению. Я ведь родился еще в 1911 году, а сознательную жизнь начинал в двадцатых. Тогда взрослели рано: среднего образования не было. Окончил семилетку — иди работать. Ну я и пошел — слесарем на Кировский завод. Пять лет там работал, а последние два года одновременно ходил на вечерний рабфак. Когда поступил в Политехнический институт, работать перестал. Учился хорошо, попадал в десятку лучших математиков, лауреатов разных. Мы все тогда думали, как бы больше хорошего сделать. Все были ударники. Соревнования разные проводились. Увлекающиеся люди были. Я, например, не мог обойтись без искусства. В неделю раз обязательно должен был куда-нибудь выходить. «Травиату» — раз двадцать слушал, «Риголетто» — десять. До сих пор могу любую оперу напеть. Чтобы легче было учиться, занимался спортом. В футбол я играл за Политехнический институт, и мы выиграли первенство СССР среди технических заведений. А в городе я играл за первую команду завода «Светлана». В 1938 году меня попросили поехать на тренировочный сбор команды «Сталинец», теперешний «Зенит». Я поехал, а они потом — туда нужно ехать, сюда на игру. А я хотел окончить институт. Поэтому я от этого отказался и стал себе в «Светлане» играть на здоровье. Немножко подплачивали нам за это, так что окончил институт нормально.

А после института в 1939 году призвали в армию. Тогда у нас военных кафедр не было. Должен был отслужить два года, чтобы потом стать офицером запаса. Я попал на Дальний Восток. Там меня война и застигла. Из нас сразу сформировали дивизию и отправили на фронт. 17 июля мы разгрузились в районе станции Бологое. Немец шел со Смоленска, мы отсюда; нужно было его остановить. Наша встреча состоялась на реке Белой между Смоленской и Калининской областями. Бой был страшный. Дивизия потеряла очень много, но и немцев мы немало побили. В конце концов все остались при своем: и мы, и они заняли оборону, но немец был остановлен. Однако 30 сентября мы оказались в окружении. Что делать? Думали даже распустить дивизию и идти в партизаны. Но приехал генерал-лейтенант Лукин и сказал: никаких! Он был очень деятельный человек и, в конце концов, после четырнадцати дней и ночей вывел нас из окружения. Вышли под Калининым. Здесь еще дней 10—15 опять комплектовались и начали наступление. Это было как раз то знаменитое наступление под Москвой, в которое перешла наша оборона. Пошли очень успешно. Дошли в конце концов до Ржева. Погода очень плохая, все дороги занесло. Да и не было почти никаких дорог! Все наши машины, «газики», сели. Несколько дней шли бои без всяких успехов с той или другой стороны. Наша дивизия сильно поредела, но

САНКТ-ПЕТЕБУРГСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ

ФАКУЛЬТЕТ

ГЕОГРАФИИ

И

ГЕОЭКОЛОГИИ

САНКТ-ПЕТЕРБУРГ
2003

МЕЖДУНАРОДНАЯ ПРОГРАММА ПОДГОТОВКИ МАГИСТРОВ ПО ПРОГРАММЕ «ПОЛЯРНЫЕ И МОРСКИЕ ИССЛЕДОВАНИЯ»

С 2002 года на факультете ведется подготовка магистров (на госбюджетной дневной основе обучения) по программе «Полярные и морские исследования». Программа реализуется совместно с шестью университетами Германии. На нее принимаются студенты Санкт-Петербургского государственного университета и других российских и зарубежных вузов.

Среди широкого круга проблем полярных регионов особое место занимают вопросы функционирования полярных геосистем, которые предполагают: исследования рельефа, геологического строения и развития полярных океанических бассейнов и их континентального обрамления; исследование осадков и неживых ресурсов океана и суши. Морские исследования базируются на знаниях океанографии открытых морей и прибрежных вод, вод суши, покровных льдов и климата полярных регионов. Важное место в исследованиях полярных областей отводится вопросам функционирования полярных геосистем, экосистем и проблемам природопользования. Последние неразрывно связаны с управлением береговыми зонами, с изучением ландшафтных систем полярных стран и ландшафтов полярных территорий в условиях антропогенного воздействия.

Программа рассчитана на бакалавров по направлениям: «Гидрометеорология», «География», «География и картография» и «Экология и природопользование», а также на специалистов по специальностям: «Метеорология», «Гидрология», «Океанология», «География», «Экология», «Природопользование», «Геоэкология», «Картография», «Прикладная информатика (в географии)».

Учебный Петербург

Санкт-Петербургский государственный политехнический университет

Факультет Открытого и Дистанционного Обучения

195251, СПб, Политехническая ул., 29,
СПбГПУ, главное здание, ком. 217
тел./факс: (812) 550-40-52

МЕЖДУНАРОДНАЯ ПРОГРАММА ПОДГОТОВКИ МАГИСТРОВ ПО ПРОГРАММЕ «ПОЛЯРНЫЕ И МОРСКИЕ ИССЛЕДОВАНИЯ»

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vom 23.12.2003

DIE WELT

Chef des AWI erhält Ehrendoktor

Bremen

Mit der Ehrendoktorwürde der Staatlichen Universität St. Petersburg ist am Mittwoch der Bremerhavener Wissenschaftler Professor Jörn Thiede ausgezeichnet worden. Der Direktor des Alfred-Wegener-Instituts für Polar- und Meeresforschung (AWI) erhielt die Auszeichnung für seine wissenschaftlichen Beiträge zur Polarforschung und für sein Engagement bei der Zusammenarbeit mit Russland. Dieses habe zum Aufbau eines Netzwerks von deutschen und russischen Wissenschaftlern geführt, teilte das AWI am Mittwoch mit.

Artikel erschienen am 13. Mai 2004

Leute

0471 - 597 263

Für seine wissenschaftlichen Beiträge zur Polarforschung sowie sein Engagement in der Zusammenarbeit mit Russland erhält Professor **Dr. Jörn Thiede**, Direktor des Alfred-Wegener-Instituts für Polar- und Meeresforschung (Awi), heute die Ehrendoktorwürde der Staatlichen Universität St. Petersburg.

Seit Anfang der 90er Jahre setzt sich Prof. Thiede für die Zusammenarbeit zwischen Deutschland und Russland in Bildung und Forschung ein. Die wissenschaftlichen Ergebnisse seiner ersten Polarexpeditionen hatten Thiede gezeigt, dass die sibirischen Schelfmeere für die Einschätzung der Entwicklung des weltweiten Klimas und der

Professor Dr. Jörn Thiede

Folgen möglicher Klimaveränderungen von unschätzbarem Wert sind. In den vergangenen Jahren hat sich ein umfassendes Netzwerk von deutschen und russischen Wissenschaftlern entwickelt, die gemeinsam die Ursachen und Auswirkungen von globalen Klimaveränderungen in der sibirischen Arktis studieren. Im Oktober 2001 mündete diese Zusammenarbeit in die Einrichtung eines internationalen Masterstudiengangs für angewandte Polar- und Meereswissenschaften an der Staatlichen Universität St. Petersburg (Pomor). Der Unterricht wird von russischen Dozenten der Universität St. Petersburg und russischer Forschungsinstitute wie dem Staatlichen Institut für Arktis- und Antarktisforschung (Aari) und deutschen Kollegen vom Alfred-Wegener-Institut, der Universität Bremen und den anderen Hochschulen im Verbund Norddeutscher Universitäten (Hamburg, Greifswald, Kiel, Oldenburg, Rostock) sowie dem Forschungszentrum IFM-Geomar erteilt.

Thiede wurde 1941 in Berlin geboren. Er studierte Geologie und Paläontologie an den Universitäten Kiel, Buenos Aires, Aarhus und Wien und promovierte 1971 an der Universität Kiel. Nach weiteren Stationen folgte 1997 schließlich die Berufung zum Direktor des Alfred-Wegener-Instituts für Polar- und Meeresforschung in Bremerhaven.

NORDSEE-ZEITUNG Mittwoch, 12. Mai 2004

По северным морям

Вручение диплома и мантии Почетного доктора СПбГУ профессору Йорну Тиде

В Петровском зале прошла торжественная церемония вручения диплома Почетного доктора Санкт-Петербургского государственного университета директору Института морских и полярных исследований им. Альфреда Вегенера профессору Йорну ТИДЕ (Германия).

Йорн Тиде изучал геологию в университетах Киля, Буэнос-Айреса, Вены и Аархуса. История оледенений Земли стала центральной темой его научно-исследовательской работы. В 1971 г. Йорн Тиде защитил диссертацию и получил ученую степень доктора наук университета г.Киль. Длинный научный путь Йорна Тиде прошел через Берген (Норвегия), Аархус (Дания), Корваллис (США) и Осло (Норвегия) и в 1982 году привел обратно в университет города Киль, где его пригласили заведовать кафедрой палеонтологии и исторической геологии. Эта должность открыла ему возможность инициировать многочисленные важные исследовательские проекты по изучению морской геологии высоких северных широт. Первыми из этих исследований стали специальный проект исследований «Осадконакопление в Европейском Северном море» Германского исследовательского общества (DFG) и экспедиция по Программе глубоководного океанского бурения (ODP). Были сделаны «шаги в Арктику» на новом немецком научно-исследовательском судне «Поларштерн», которые завершились в 1991 г. экспедицией на Северный полюс и в 1993 г. первым бурением в Северном Ледовитом океане по программе ODP. Поддержку профессору оказывали его многочисленные студенты и аспиранты, многие из которых до сих пор работают в его коллективе. Новыми важными этапами на профессиональном пути Йорна Тиде было основание Научно-исследовательского центра по морским геологическим наукам ГЕОМАР в г.Киль, где он стал первым директором, и последовавшее приглашение Тиде на должность директора Института полярных и морских исследований им. Альфреда Вегенера в г.Бремерхафен.

В 1991 г. состоялась первая совместная российско-немецкая экспедиция для исследования моря Лаптевых. Инициатива Йорна Тиде открыла пути к многолетнему тесному взаимодействию немецких и российских ученых, совместно изучающих основы глобальных изменений климата и их воздействие на сибирскую Арктику. Важными результатами совместных проектов Йорна Тиде с российскими учеными стали основание Лаборатории полярных и морских исследований им. Отто Юльевича Шмидта при Государственном научном центре Российской Федерации, Научно-исследовательском институте Арктики и Антарктики, и ПОМОР, магистерская программа «Прикладные полярные и морские исследования» в Санкт-Петербургском государственном университете.


Йорн Тиде

В последние годы за научные достижения Йорну Тиде были присуждены многочисленные национальные и международные награды и премии, в том числе премия им. Лейбница Германского исследовательского общества (DFG). Он избран почетным иностранным членом Российской Академии наук.

AWI

Hamburger Abendblatt	18.05.04	G 301,1 (Sa: 388,1) Auflage x 1000
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MEERESFORSCHUNG

Ehrendoktor für Prof. Thiede

Mit der Ehrendoktorwürde der Staatlichen Universität St. Petersburg ist der Bremerhavener Wissenschaftler Prof. Jörn Thiede ausgezeichnet worden. Der Direktor des Alfred-Wegener-Instituts für Polar- und Meeresforschung erhielt die Auszeichnung für seine Beiträge zur Polarforschung und für sein Engagement bei der Zusammenarbeit mit Russland. Dieses habe zum Aufbau eines Netzwerkes von deutschen und russischen Wissenschaftlern geführt. *(dpa)*

– Еще учась на последнем курсе магистратуры, я сдала кандидатский минимум: английский язык и философию. То есть фактически закончила первый курс аспирантуры. Современные правила обучения это позволяют – и кроме меня, еще трое ребят с нашего курса, с других кафедр, сделали то же самое. Теперь осталось сдать специальность – и можно садиться за написание кандидатской диссертации. Правда, я еще не знаю точно, о чем она будет. Хотя генеральное направление исследований определено: социально-политические аспекты, связанные с мусульманским мистицизмом в Центральной Азии.

– А если попробовать заглянуть еще дальше в будущее? Каким вы его видите? Мне рассказывали, что выпускники факультета работают в дипломатических представительствах, в фирмах – в том числе западных (а не только восточных). Какой путь вы наметили для себя?

– Не люблю далеко загадывать – видимо, я человек "ближней дистанции". Но если предполагать, то буду заниматься, скорее всего, преподавательской деятельностью – в университете или другом вузе. Ну, и наукой, конечно же: буду продолжать свои исследования...

– В своем недавнем послании президент высказал такую идею: студенты, которые обучаются на бюджетной основе, должны отдать долг Родине – и поработать после окончания вуза там, куда их направят. По распределению, как говорили в советское время... Как вам нравится такая перспектива? Что бы вы делали, если бы такой закон уже обрел бы силу сегодня?

– Что бы я предприняла, точно сказать не могу. Вот если окажусь в подобной ситуации, тогда и буду решать конкретно... Но к подобной идее я отношусь отрицательно. Мы все же живем в свободной стране, и можем сами выбирать, что делать, куда идти учиться и работать. Я, конечно, понимаю: аргументация президента вполне обоснованна. И экономическая подоплека, и социальная польза от таких мер тоже очевидна. Но, с другой стороны, востоковеда трудно распределить по специальности. И еще многое будет зависеть от сроков отработки.

– Но в любом случае, даже в советское время поступивших в аспирантуру не распределяли, а парней – не отправляли в армию. Так что остается, Мария, только пожелать вам успехов на избранном вами пути! Пусть в жизни все сложится, как вы задумали...

Евгений ГОЛУБЕВ

Выпускник 2004

Два диплома лучше, чем один!

В этом году состоялась первая защита магистерских диссертаций на географическом факультете в рамках российско-немецкой программы арктических и полярных исследований «ПОМОР» (POMOR). И хотя процедура защиты дипломов отработана десятилетиями, новые формы обучения, примером которых является формат программы «ПОМОР», внесли изменения и в методику подготовки дипломных работ.

У магистрантов-"поморцев" было два научных руководителя – с российской и немецкой стороны, научные консультанты из научных исследовательских институтов и центров обеих стран.

Главное же отступление от традиций состояло в том, что магистерскую диссертацию нужно было писать на тему, совершенно новую для дипломника. До поступления в магистратуру молодые люди окончили либо естественные факультеты СПбГУ (географический, геологический), либо гидрометеорологический институт. Дипломные же работы выполнялись на стыке экономики и географии, географии и биологии, географии и астрономии и так далее.

Наталья Ваганова защищала работу "Балтийское море в условиях антропогенной нагрузки". В ней представлена комплексная оценка экологического состояния Финского залива на основе мониторинговых исследований, в которых принимала участие сама выпускница. Как отметили рецензенты, работа Натальи – самостоятельное законченное исследование, выводы сделаны на большом фактическом материале. «Замечаний по работе нет, что является редким случаем», – такая формулировка прозвучала при обсуждении работы. И далее финальная фраза, радующая слух каждого дипломника: исследование заслуживает присвоения магистерского звания, автору рекомендована учеба в аспирантуре.

Дарья Васильева в своей работе "Содержание водяного пара в районе озера Саданкюля по данным различных методов радиозондирования" использовала данные, полученные ею во время исследований, проводившихся в Арктическом центре Финляндии.

Как подчеркнула Даша на защите диплома, она получала информацию непосредственно от создателей тех приборов, на которых проводилась ее исследовательская работа.

Высокий уровень научных обобщений был отмечен в магистерской диссертации **Елены Разуваевой.** Елена после кораблестроительного института продолжила образование на географическом факультете СПбГУ. Будучи студенткой, она стала сначала стажером, а затем и

На снимке: Ирина Иванова и Наталья Ваганова

научным сотрудником ВНИИ океанологии, участвовала в арктических экспедициях, международных научных конференциях.

Как рассказала после защиты Елена, специалисты ВНИИ океанологии давно сотрудничают с немецкими коллегами и посоветовали ей пройти обучение по программе POMOR. Сегодня многие немецкие ученые-экологи, географы заинтересованы в изучении наших северных морей, но данные на русском языке им недоступны. «Они использовали обзоры наших дипломных работ, а мы использовали их технологии и оборудование», – так прокомментировала одну из сторон сотрудничества по программе «POMOR» Е.Разуваева.

Юлии Стрельченко, гидрогеологу по базовому образованию, пришлось освоить для своих исследований новый для нее прибор – звездный фотометр, так как ее работа проводилась на стыке геофизики и астрономии. Ее консультантами были специалисты государственной обсерватории.

Ирина Иванова защищала магистерскую диссертацию «Условия устойчивого развития коренных народов северных регионов России» (на примере Республики Коми). Ей потребовались знания из области экономики, географии, демографии и социологии. Работа рекомендована к публикации и представлению в правительство Республики Коми для ознакомления с предложенными в ней выводами. Пожалуй, тема этого диплома была одной из немногих, предложенных российской стороной и не вызвавшей замечаний немецких коллег.

Как отметила научный руководитель этой работы Светлана Александровна ЧЕРНИКОВА, доцент кафедры экологической безопасности и устойчивого развития регионов, по ее мнению, при обсуждении тематики дипломных работ немецкой стороной был проявлен не диктат, как считают некоторые российские преподаватели, а заявка на новый подход к демонстрации возможностей выпускников-магистров. Тема, предложенная Черниковой, была принята обеими сторонами, так как не являлась развитием ранних работ студентки и представляла для нее совершенно новую задачу для исследований. С точки зрения немецких коллег, очень важен такой подход: если ты защищаешь магистерскую степень, ты должен быть

a) комплексно образован,

b) способен в любой из изученных тобой областей науки выполнить квалификационную работу,

c) сориентироваться в проблеме.

Наши студенты доказали, что способны это сделать. «Для нас это ново, – далее сказала Светлана Александровна, – у нас акцент – на глубину, а у немецких коллег – на адаптационные возможности, способность реализовать себя».

* * *

Первые итоги работы по программе прокомментировал декан факультета географии и геоэкологии Василий

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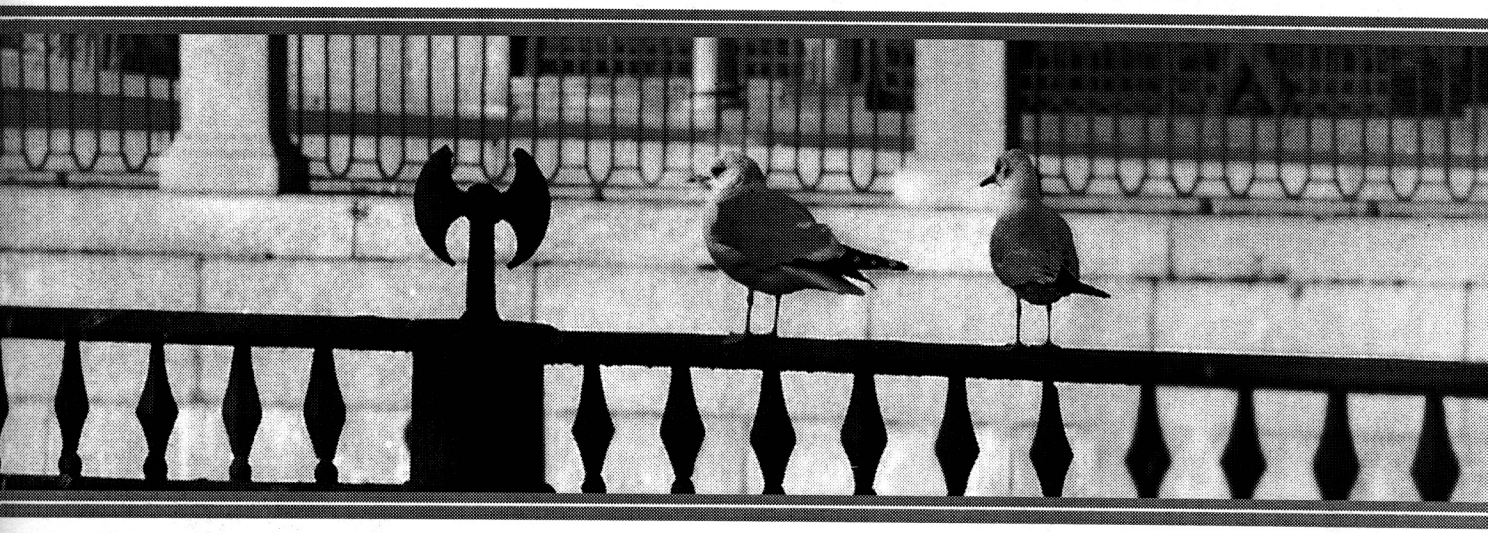
Санкт-Петербургский УНИВЕРСИТЕТ

HIC TUTA PERENNAT



№ 27-28 (3686-3687), ноябрь 26, 2004

В эти дни в университете работает международная конференция, на которой обсуждаются проблемы Болонского процесса. Сотрудничество европейских стран в сфере образования — одна из тем обсуждения. Наш университет дает хорошие примеры такого понимания Болонского процесса.

POMOR – ещё одно достижение

Первого ноября 2004 года в Петровском зале Санкт-Петербургского государственного университета состоялось торжественное вручение дипломов "Master of Sciences" СПбГУ и Бременского университета первому выпуску программы по подготовке магистров в области прикладных морских и полярных исследований.

С сентября 2002 года в Санкт-Петербургском государственном университете была утверждена германско-российская образовательная программа по прикладным морским и полярным наукам POMOR. Эта программа является прообразом всех программ, по которым будут обучаться магистры. Её главная цель – дать возможность молодым российским студентам пройти обучение по программе международного образца, отвечающей требованиям Болонской конвенции, не покидая своей страны. Таким образом, впервые 18 российских студентов получили магистерский диплом Бременского и Санкт-Петербургского университетов в области прикладных морских и полярных исследований.

Счастливые обладатели дипломов «Master of Sciences».

В течение двух лет студенты занимались с преподавателями Бременского и Санкт-Петербургского университетов. Наряду с естественнонаучными предметами студенты изучали иностранные языки и приемы проведения научных презентаций. Учебный процесс был максимально приближен к практике: универсанты даже участвовали в научно-исследовательских экспедициях.

Об успешности программы POMOR может свидетельствовать то, что ещё до официального вручения дипломов некоторым студентам предложили трудоустройство, в том числе и в Германии.

В данный момент 16 аспирантов, успешно прошедших тест по английскому языку и являющихся теперь новыми студентами программы POMOR, намерены не только повторить, но и улучшить результаты своих предшественников.

Программа POMOR не только является гарантией успешного будущего своих выпускников, но также свидетельствует об успешном сотрудничестве Германии и России в области науки.

Проект POMOR реализуется при поддержке Санкт-Петербургского государственного университета, Бременского университета совместно с Институтом морских и полярных исследований им.Альфреда Вегенера (AWI), Институтом морских наук им. Лейбница (IFM-GEOMAR) и Союзом Северогерманских университетов. Финансирование проекта осуществляется с 2001 года Германской службой академического обмена DAAD (Контактная организация: DAAD-Programm: Studienangebote Deutscher Hochschulen im Ausland) из средств Федерального министерства образования и науки.

В дальнейшем программа по подготовке магистров должна стать доступной и студентам других европейских стран.

Мария КИРИЛЛОВА

„Wir Europäer müssen aufpassen, dass die besten russischen Forscher nicht abwandern"

Edelgard Bulmahn
Bundesforschungsministerin

INTERVIEW

STRATEGIE

- **Deutsche und Russen** sollen in der Wissenschaft nach den Plänen von Edelgard Bulmahn gemeinsam an die Weltspitze streben.
- **Die Bundesministerin** aus Niedersachsen leitet das Ressort für Forschung und Bildung seit 1998.

„Feindbild ist längst passé"

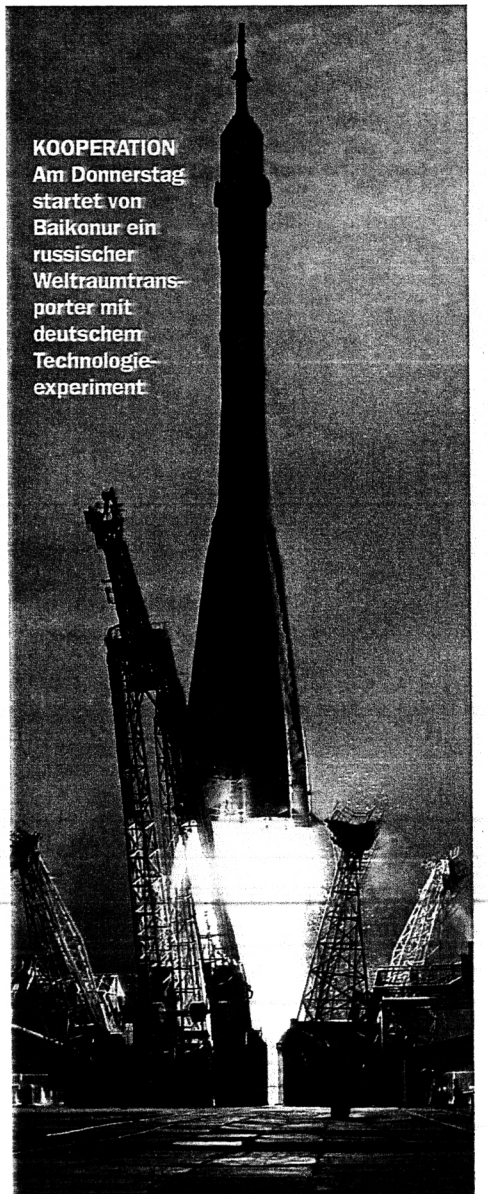
Forschungsministerin Edelgard Bulmahn (SPD) plant eine Partnerschaft mit Russland bei Raumfahrt, Wissenschaft und Technologie

FOCUS: Können Amerika und Europa heute froh sein, dass es den früheren Gegner in der Raumfahrt noch gibt?

Bulmahn: Das alte Feindbild ist in der Forschung längst passé. Russland ist eine der führenden Weltraumnationen und hat hervorragende Wissenschaftler und Techniker. Wir Europäer müssen aufpassen, dass die besten russischen Forscher nicht in andere Regionen der Welt abwandern. Große Forschungsprojekte wie die internationale Raumstation ISS erfordern eine Zusammenarbeit von Europa, Russland und den USA. Ohne die russischen Raumschiffe hätten wir keinen Zugang zur ISS. Heute nutzen wir sogar russische Raketen, um europäische Satelliten zu starten. Mitte 2007 werden Sojus-Raketen vom europäischen Weltraumbahnhof in Kourou ins All fliegen.

FOCUS: Wird da noch mehr draus?

Bulmahn: Wir wollen mit Russland eine strategische Partnerschaft auf wichtigen Forschungsgebieten vereinbaren, die mit konkreten Projekten bis 2010 reicht. Bundeskanzler Schröder und Präsident Putin werden bei den deutsch-russischen Konsultationen in Hamburg ein Programm für die künftige Zusammenarbeit in Auftrag geben. Beide Länder sollen in Bereichen von Raumfahrt, Bio- und Nanotechnologie, Meeres- und Polarforschung sowie Aus- und Weiterbildung weltweite Spitzenpositionen anstreben. Wir wollen auch den Austausch von Nachwuchswissenschaftlern vorantreiben. Die gegenseitige Anerkennung von Studienabschlüssen soll verbessert werden. Im Februar werde ich zu Verhandlungen mit meinem russischen Kollegen Fursenko nach Moskau reisen. Bis zum Mai 2005 soll das Programm unterschriftsreif sein.



KOOPERATION Am Donnerstag startet von Baikonur ein russischer Weltraumtransporter mit deutschem Technologieexperiment

FOCUS: Was spricht dafür?

Bulmahn: Russland ist außerhalb der EU bei Bildung und Forschung unser wichtigster Partner. Seit 1992 betreiben beide Länder 100 gemeinsame Forschungsprojekte. Allein in den letzten fünf Jahren förderte unser Ministerium die Zusammenarbeit mit über 50 Millionen Euro. Der akademische Austausch wurde mit 17 Millionen Euro unterstützt. Inzwischen bestehen 550 Hochschulpartnerschaften. 6300 Studenten, Dozenten und Forscher arbeiten an Einrichtungen beider Länder zusammen. Deutsche und russische Wissenschaftler kooperieren vor allem in der Grundlagenforschung wie der Physik. 2003 zum Beispiel beteiligten sich 140 russische Kollegen mit Experimenten am Deutschen Elektronen-Synchrotron in Hamburg.

FOCUS: Und bei der Raumfahrt?

Bulmahn: Ein Beispiel für die künftige strategische Kooperation zeigen Deutschland und Russland bereits am 23. Dezember. Von Baikonur startet das deutsche Technologieexperiment ROKVISS mit dem russischen Weltraumtransporter „Progress" zur ISS. Im freien Weltraum werden dann hoch integrierte Roboterkomponenten getestet. Erstmals soll ein Roboterarm im All von der Erde ferngesteuert ohne Zeitverzögerung arbeiten. Deutschland setzt bei der Erkundung des Weltalls auf robotische Technik. Unsere Roboter sollen bei Raumflugmissionen zum Einsatz kommen. ■

INTERVIEW: OLAF OPITZ

Fotos: Dieter Bauer/Focus-Magazin, Gamma

Zwei-Jahresbericht Stiftung Alfred-Wegener-Institut für Polar- und Meeresforschung
in der Helmholtz-Gemeinschaft:

http://www.awi-bremerhaven.de/AWI/Presse/veroeff/docs/Kap2_16-26.pdf

Wer sind die POMORen?

Kirsten Tuschling, Heidemarie Kassens, Vladimir Troyan, Jörn Thiede, Gerold Wefer

Die Pomoren? Das ist doch ein seefahrendes und Handel treibendes Völkchen im Norden Russlands. Ja und nein – für uns sind die Pomoren zwanzig wissbegierige Studierende, die seit Oktober 2002 im Masterprogramm für angewandte Polar- und Meereswissenschaften POMOR in St. Petersburg studieren. Den internationalen Studiengang haben deutsche und russische Kollegen gemeinsam konzipiert und gemeinsam unterrichten sie in den extra eingerichteten Räumen an der Staatlichen Universität St. Petersburg.

Praxisnah werden die Studierenden an die modernen Themen und Methoden der Polar- und Meereswissenschaften herangeführt. Dabei werden aufbauend auf den Disziplinen Ozeanographie, Meeresbiologie und Geowissenschaften neben natur-, ingenieur- und wirtschaftswissenschaftlichen Aspekten auch Kenntnisse in der Informationsvermittlung und Kommunikationstechnik vermittelt. Nach vier Semestern soll das Aufbaustudium in Anlehnung an einen Masterstudiengang der Universität Bremen mit einem Master of Science abschließen. Die ersten drei Semester sind dem Unterricht in St. Petersburg gewidmet. Jeweils zwei polar- und meereswissenschaftliche Module, dazu Wissenschaftsgeschichte, Sprachunterricht, Präsentationstrainings und Spezialkurse, z.B. zur Atmosphärenforschung, stehen auf dem Stundenplan. Die eine Hälfte des Unterrichts wird von russischen Dozenten, die andere von deutschen Kollegen des Alfred-Wegener-Instituts, der Universität Bremen und der anderen Hochschulen im Verbund Norddeutscher

Who are the POMORs?

Kirsten Tuschling, Heidemarie Kassens, Vladimir Troyan, Jörn Thiede, Gerold Wefer

The pomors? Why, they are a small seafaring and trading people living in Russia's north, aren't they? Yes and no - for us the pomors are 20 eager students who have been studying in the framework of the Master Program for Applied Polar and Marine Sciences POMOR in St. Petersburg since October 2002. This international program was jointly planned by German and Russian colleagues. Together they give their lectures and courses on the premises especially furnished for this purpose at St. Petersburg State University.

In a practice-oriented way the students are introduced to the current topics and methods of polar and marine sciences. In addition to aspects of natural sciences, engineering and economy, knowledge in information and communication technologies is imparted on the basis of the technical fields of oceanography, marine biology and geosciences. After four semesters, the degree of Master of Science is conferred to the students of this postgraduate program in accordance with a master program offered by the University of Bremen. In the first three semesters lectures and courses are to be attended in St. Petersburg. The schedule comprises two modules each of polar and marine sciences as well as history of science, language courses, courses for presentation skills and special courses, e.g., in atmospheric research. One half of the courses and lectures is given by Russian colleagues, the other by German colleagues from the Alfred Wegener Institute, the University of Bremen and the other universities

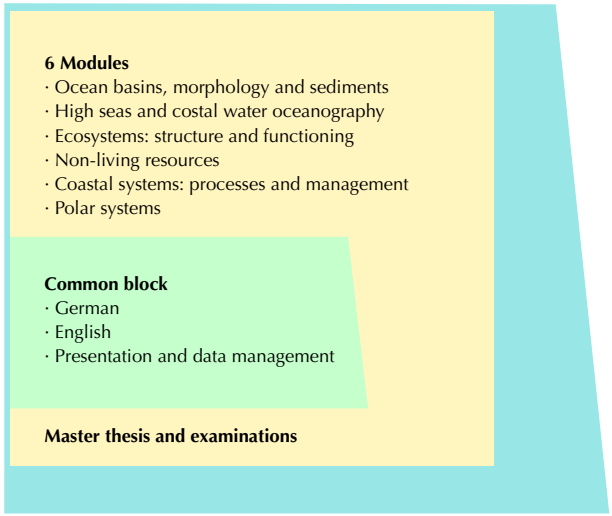


Abb. 1: Curriculum des zweijährigen Masterstudiengangs.

Fig. 1: Curriculum of the two-year master program.

Universitäten (Hamburg, Greifswald, Kiel, Oldenburg, Rostock) sowie des IfM-GEOMAR erteilt. Die Übungen werden teilweise am deutsch-russischen Otto-Schmidt-Labor für Polar- und Meeresforschung (OSL) in St. Petersburg durchgeführt. Damit die Praxis nicht zu kurz kommt, nehmen alle Studierenden nach zwei Semestern an Expeditionen oder Feldpraktika teil. 2003 schnupperten POMOR-Studierende auf Schiffs-Expeditionen in die Arktis See- und Laborluft. Eine weitere Gruppe besuchte die Koldewey-Station des AWI auf Spitzbergen um die Mess- und Auswertetechniken der Atmosphärenwissenschaften in der Praxis kennen zu lernen. Das vierte Semester steht dann

within the Consortium of Universities in Northern Germany (Hamburg, Greifswald, Kiel, Oldenburg, Rostock) and the IfM-GEOMAR. Some of the practical courses are given at the German-Russian Otto Schmidt Laboratory for Polar and Marine Research (OSL) in St. Petersburg. After two semesters all students take part in expeditions or field courses so that they are also provided with practical knowledge. In 2003 some POMOR students got a glimpse of arctic seas and ship laboratories during marine expeditions. Another group went to the Koldewey Station of the Alfred Wegener Institute on Spitsbergen to become practically acquainted with the measuring and processing techniques of atmospheric sciences. The fourth semester will focus on the master thesis and the preparation for the final examination.

As the cooperation of German and Russian colleagues in the framework of polar and marine research had continually intensified during the past ten years, the request for establishing a German faculty in St. Petersburg, expressed by undersecretary of state Catenhusen during his visit to the OSL in spring 2001, was eagerly taken up. The establishment of the joint program of studies, POMOR, is the first step in this direction and promotes the consolidation of the successful cooperation between Germany and Russia in the field of sciences and education as well as the internationalization of university education in both countries.

POMOR is funded by the German Academic Exchange Service (DAAD) in the framework of the program 'Export of German University Programs' as well as by the research institutions and universities involved.

Abb. 2: Praktisches Lernen im Polargebiet: Studentenexkursion nach Spitzbergen im September 2003.

Fig. 2: Practical course in polar sciences. Excursion of the students to Spitsbergen in September 2003. (Photo: H. Kassens)

unter den Zeichen „Masterarbeit“ und „Büffeln für das Examen“.

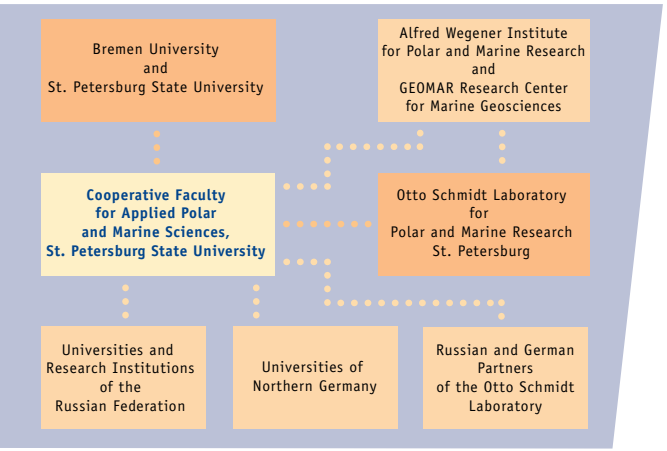
Nachdem sich die Zusammenarbeit mit russischen Kollegen in der Polar- und Meeresforschung während der letzten zehn Jahre beständig intensiviert hat, traf der bei seinem Besuch am OSL im Frühjahr 2001 geäußerte Wunsch des Staatssekretärs Catenhusen, eine deutsche Fakultät in St. Petersburg einzurichten, auf fruchtbaren Boden. Die Einrichtung des gemeinsamen Studiengangs POMOR ist ein erster Schritt in diese Richtung und dient neben der Vertiefung des erfolgreichen Zusammenwirkens Deutschlands und Russlands im Wissenschafts- und Bildungsbereich auch der Internationalisierung der Universitätsausbildung in beiden Ländern.

Finanziert wird POMOR vom Deutschen Akademischen Austauschdienst im Rahmen des Programms „Export deutscher Studienangebote“ sowie den beteiligten Forschungseinrichtungen und Universitäten.

8. Faltblatt und Broschüre

Study program

During a two-year study the master program POMOR imparts knowledge of the polar and marine environmental systems from coastal to deep sea region and applied aspects including the scientific approaches and methods of the various disciplines as, for instance, oceanography, marine geosciences and marine biology. It is completed with a Master of Science. Students with a bachelor or diploma degree in one of the connected disciplines of natural sciences can apply for the program. Courses are given in English and Russian.



The course of study consists of three study semesters and one final semester. In the first three semesters lectures, seminars and practical exercises are given. In addition the students take part in an excursion. Over two years courses are divided into a scientific part with six modules in the field of polar and marine sciences (168 hours of lessons each) and a general block.

In the fourth semester students spend at least four weeks in being practically trained at universities, research institutes, public authorities or relevant companies in Germany. In this semester the master thesis must also be written and the final exam be taken.

6 Modules

- Ocean basins, morphology and sediments
- High seas and coastal water oceanography
- Ecosystems: structure and functioning
- Non-living resources
- Coastal systems: processes and management
- Polar systems

Common block

- German
- English
- Presentation and data management
- Master thesis and examinations

pomor
MASTER PROGRAM
for applied polar and marine sciences

Russian project office:

POMOR – master program for applied polar and marine sciences

c/o St. Petersburg State University
Faculty for Geography and Geoecology
33, 10th line
199178 St. Petersburg/Russia

Phone/Fax: + 78 12 / 3 23 99 76
Email: secretariat@pomor.org
www.pomor.de

German project office:

POMOR – master program for applied polar and marine sciences

c/o Stiftung Alfred-Wegener-Institut für Polar- und Meeresforschung in der Helmholtz-Gemeinschaft
P. O. Box 120161
27515 Bremerhaven/Germany

Phone: + 49 471 / 48 31 11 52
Fax: + 49 471 / 48 31 11 02
Email: ktuschling@awi-bremerhaven.de

pomor
MASTER PROGRAM
for applied polar and marine sciences

A Russian-German initiative in science and education

POMOR is a joint initiative of the St. Petersburg State University (SPbU), Bremen University, the Alfred Wegener Institute for Polar and Marine Research and the GEOMAR Research Center for Marine Geosciences in cooperation with the Consortium of Universities in Northern Germany (Universities of Bremen, Greifswald, Hamburg, Kiel, Oldenburg, and Rostock). POMOR offers a chance for advanced students who want to finish their study with a master degree in polar and marine sciences. The courses are mainly given at the Faculty for Geography and Geoecology of the SPbU and at the cooperating Otto Schmidt Laboratory for Polar and Marine Research in St. Petersburg.

Official opening in November 2002 (photo H. Kassens)

Students of POMOR (photo: H. Kassens)

River breakup of the Lena in June 1999 (photo: H. Kassens)

Polar ecosystems

Polar regions are characterized by all-year-round cold temperatures, strong seasonal changes in the availability of light (polar day and night), the existence of sea ice and giant glaciers. Antarctica with its mighty overlying ice sheet and the surrounding Southern Ocean is a very old ecosystem the glaciation of which began already approximately 40 million years ago. The northern polar region consists of the Arctic Ocean with its wide shelf seas and tundra, mountains and glaciers of the adjacent continents and islands. Here the glaciation began only 10 million years ago.

Environmental processes in the Arctic and in Antarctica, as for instance deep-water and bottom-water formation functioning as "carbon pump", significantly contribute to global environmental conditions. Environmental changes have a faster and more distinct impact in polar regions. Therefore polar ecosystems function as an early-warning system for the global environmental system.

Marine ecosystems

Open oceans and their adjacent shelf regions cover about 70% of the earth's surface. They play an important role in global and regional climate, constitute habitats for organism communities in the water, at the seafloor, and in the sea ice. They also cover large amounts of natural resources. The aim of modern marine research is to define the role oceans play in processes of climate and environmental change. For this purpose the physical, chemical and biological aspects influencing climate, ocean currents and marine ecosystems are analyzed.

Coastal regions and deposits are also part of the marine ecosystem. They are exploited by man to a large extent. Their sustainable use is one of the challenges in the 21st century.

Tundra in Central Siberia (photo: M. Sommerkorn)

Applied aspects of polar and marine sciences

Applied aspects of polar and marine sciences deal in particular with the protection of the global environment and with the sustainable management of resources. In this respect the investigation and evaluation of climate changes are a basis for political measures to protect the earth system. Detailed knowledge in polar and marine sciences is needed for coastal zone management. Constructing facilities for oil and gas exploration of the seafloor or urban development on permafrost also makes that kind of knowledge inevitable.

Funding

POMOR is funded by the German Academic Exchange Service (DAAD) within the framework of the program for future development (ZIP) of the German Federal Goverment, Bremen University, St. Petersburg State University, the Alfred Wegener Institute for Polar and Marine Sciences and the GEOMAR Research Center for Marine Geosciences in cooperation with the Consortium of Universities in Northern Germany and the Hanse Institute for Advanced Study.

pomor

Polar and Marine sciences

MASTER PROGRAM

for applied polar and marine sciences

... auf der Suche nach Förderern

... в поиске спонсоров

Inhalt

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Kontakt der Projekte:

Staatliches Forschungszentrum
für Arktis- und Antarktisforschung (AARI)
Otto-Schmidt-Labor
für Polar und Meeresforschung (OSL)
Bering-Str. 38
199397 St.-Petersburg, Russland

Telefon/Fax: +49 431 600 2850
hkassens@ifm-geomar.de
www.otto.nw.ru

Leibniz-Institut für Meereswissenschaften
Sekretariat System Laptev-See
Wischhofstr. 1–3
D-24148 Kiel

Telefon/Fax: +49 431 600 2850
hkassens@ifm-geomar.de
www.geomar.de/sci_dpmt/
paloz/laptev

Universität Leipzig,
Institut für Geophysik und Geologie
Martin Melles
Talstraße 35
D-04103 Leipzig
melles@rz.uni-leipzig.de
www.geo.uni-leipzig.de/~geologie/melles_
elgygytgyn.html

Leibniz- Institut für Meereswissenschaften
Nicole Biebow,
Tethys Geoconsulting GmbH
Wischhofstr. 1–3
D-24148 Kiel

Telefon: +49 431 600 1415
nbiebow@ifm-geomar.de
www.ifm-geomar.de/projekte/komex

Контактный адрес:

Государственный исследовательский центр
по изучению Арктики и Антарктики
Лаборатория морских и полярных
исследований имени Отто Шмидта
Ул. Беринга, д. 38
199397 С.-Петербург, Россия

Телефон/факс: +49 431 600 2850
hkassens@ifm-geomar.de
www.otto.nw.ru

Leibniz-Institut für Meereswissenschaften
Sekretariat System Laptev-See
Wischhofstr. 1-3
D-24148 Kiel

Телефон/факс: +49 431 600 2850
hkassens@ifm-geomar.de
www.geomar.de/sci_dpmt/
paloz/laptev

Universität Leipzig,
Institut für Geophysik und Geologie;
Martin Melles;
Talstraße 35
D-04103 Leipzig
melles@rz.uni-leipzig.de;
www.geo.uni-leipzig.de/~geologie/melles_
elgygytgyn.html

Leibniz- Institut für Meereswissenschaften
Nicole Biebow,
Tethys Geoconsulting GmbH
Wischhofstr. 1-3
D-24148 Kiel

Телефон: +49 431 600 1415
nbiebow@ifm-geomar.de
www.ifm-geomar.de/projekte/komex

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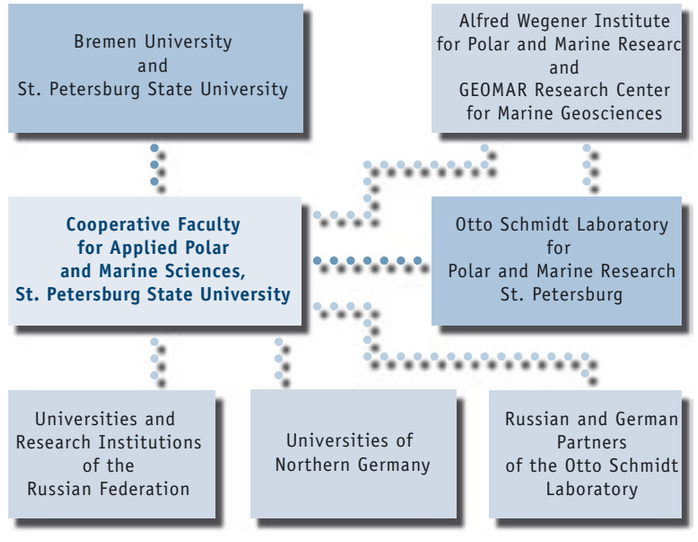

| Netzwerk der kooperierenden Institute
| Netzwerk der kooperierenden Institute

> »POMOR« – Ein innovatives Studienkonzept für die angewandten Polar- und Meereswissenschaften

> «POMOR» – инновационная учебная программа поддержки прикладных полярных и морских исследований

KOOPERATIONEN ÜBER DIE GRENZEN von Disziplinen, Organisationen und Nationen hinweg spielen eine zentrale Rolle in der modernen Wissenschaft und auf dem akademischen Arbeitsmarkt und sichern die Konkurrenzfähigkeit im internationalen Vergleich. Das gemeinsame moderne Studienprogramm in den angewandten Polar- und Meereswissenschaften an der Staatlichen Universität St.Petersburg (Abbildung rechts) POMOR vertieft die gute Kooperation zwischen Deutschland und Russland sowie anderen europäischen Nationen im Bildungs- und Forschungsbereich und knüpft an Jahrhunderte alte Traditionen. Jungen russischen Studierenden ein internationales, auf die Vereinbarungen von Bologna bauendes Ausbildungsprogramm im eigenen Land zu bieten, ist das wichtigste Ziel von POMOR. Der Import akademischer Trainings- und Forschungsprogramme aus Deutschland mit seinen westlichen Partnern in das wirtschaftlich und demokratisch aufstrebende Partner- und Nachbarland sichert langfristig die wissenschaftliche und wirtschaftliche Zusammenarbeit zwischen unseren Ländern.

СОВМЕСТНЫЕ проекты, выходящие за пределы отдельных дисциплин, организаций и наций, играют центральную роль в современной науке и на рынке труда, связанном с наукой и высшей школой, именно они являются залогом конкурентноспособности на международном уровне. Современная совместная учебная программа по содействию прикладным морским и полярным исследованиям на базе Санкт-Петербургского государственного университета (фото справа) «ПОМОР» развивает взаимовыгодное сотрудничество между Германией, Россией и другими европейскими странами в сфере образования и науки, опираясь на многовековые традиции. Важнейшая цель программы «ПОМОР» - предложить молодым российским студентам на родине международную образовательную программу в рамках достигнутых в Болонье договоренностей. Предоставление стране-соседу и партнеру, которая переживает подъем в экономике и в деле созидания демократии, учебных и исследовательских программ для нужд высшей школы из Германии и европейских стран-партнеров является залогом долгосрочного научного и экономического сотрудничества между нашими странами.

POMOR ist die konsequente Weiterentwicklung eines Prozesses sich stetig intensivierender Kooperationen, der unmittelbar nach der Perestroika eingesetzte. Bei gemeinsamen Forschungsvorhaben in der sibirischen Arktis und dem angrenzenden Nordpolarmeer wurde deutlich, dass für die gemeinsame Auswertung der gewonnen Proben und Daten ein modernes Forschungslabor in Russland eine unverzichtbare Basis darstellt. Das deutsch-russische Otto-Schmidt-Labor in St.-Petersburg stellt seit 1999 die gemeinsame Auswertung hochwertiger Forschungsergebnisse sicher. Um den studentischen Nachwuchs aus Russland, und bald auch aus Deutschland und anderen westeuropäischen Partnerländern, für die Angewandten Polar- und Meereswissenschaften auszubilden, wurde im Herbst 2002 der gemeinsame Studiengang POMOR von den erfahrenden Projektpartnern (Abbildung links) eingerichtet. Diese Projektpartnerschaft kann jederzeit erweitert werden. Der Aufbau des Studiengangs wurde durch den DAAD gefördert.

Программа «ПОМОР» возникла в процессе последовательного развития все более и более крепнущих совместных связей, начало которым положила перестройка. При планировании совместных исследовательских проектов в арктических регионах Сибири и в прилегающем к ним Северном Ледовитом Океане стало ясно, что наличие современной исследовательской лаборатории в России является необходимой базой для анализа полученных проб и данных. Российско-германская лаборатория имени Отто Шмидта в Санкт-Петербурге позволяет проводить совместный анализ результатов исследований, имеющих огромное значение. Для подготовки студентов – будущих ученых в области прикладных морских и полярных исследований как из России, так и в скором будущем из Германии и других западноевропейских стран-партнеров осенью 2002 года опытными учеными и преподавателями (фото слева) была создана общими усилиями учебная программа «ПОМОР». В любой момент данную программу можно расширить. Немецкая служба академических обменов (DAAD) поддержала организацию этой программы.

6 Modules

- Ocean basins, morphology and sediments
- High seas and coastal water oceanography
- Ecosystems: structure and functioning
- Non-living resources
- Coastal systems: processes and management
- Polar systems

Common block

- German
- English
- Presentation and data management
- Master thesis and examinations

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> »POMOR« – Ein Modellstudiengang

> «ПОМОР» – первая учебная программа в данной области

POMOR, BENANNT NACH seefahrenden Händlern im Norden Nordosteuropas und gleichzeitig Akronym für das deutsche Wort Polar und das russische Wort Morje (Meer), ist ein durch und durch kooperativ gestaltetes Studienprogramm. 20 wissbegierige Studierende studieren derzeit im Masterprogramm für angewandte Polar- und Meereswissenschaften POMOR. Den internationalen Studiengang haben deutsche und russische Kollegen gemeinsam konzipiert und gemeinsam unterrichten sie in den extra eingerichteten Räumen an der Staatlichen Universität St. Petersburg, betreuen die Praktika und Masterarbeiten und nehmen die Prüfungen ab.

СВОИМ НАЗВАНИЕМ ПРОГРАММА «ПОМОР» обязана купцам, занимавшимся торговлей по морю на севере С.-В.Европы, и акрониму, составленному из немецкого слова «Polar» (полярный) и русского слова «море». Она представляет собой учебную программу, созданную совместными усилиями. В настоящее время 20 заинтересованных студентов проходят обучение в рамках магистерской программы прикладных морских и полярных исследований «ПОМОР». Немецкие и российские ученые и преподаватели вместе разработали международную программу. Вместе они и преподают в специально оборудованных для этого аудиториях Санкт-Петербургского государственного университета, вместе руководят практиками и выпускными работами, вместе принимают экзамены.

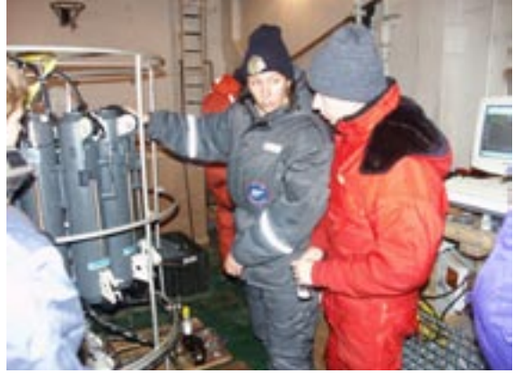
Der Studiengang – Lernfelder

Praxisnah die wesentlichen Kenntnisse in den Angewandten Polar- und Meereswissenschaften zu erlernen, ist das Unterrichtsziel (Abbildung links). In dem modular aufgebauten Studiengang werden in den ersten drei Semestern sechs Module, beginnend mit der Vermittlung von naturwissenschaftlichen Grundlagen bis hin zu Spezialkenntnissen, unterrichtet. Flankierend lernen die Studierenden Sprachen und Moderationstechniken. Und ein richtiger POMOR muss auch einmal im Polargebiet oder auf See gearbeitet haben. Im Herbst 2003 nahmen die Studierenden an einer Eisbrecher-Expedition in die sibirische Laptev-See und an einer Exkursion zum "Wissenschaftsdorf Ny Ålesund" auf Spitzbergen teil. Im vierten Semester müssen die Studierenden dann in der Masterarbeit und den Examensprüfungen ihr Können beweisen.

Учебная программа – основные звенья

Целью обучения является получение теоретических и практических знаний и умений, необходимых для дальнейшей работы в сфере прикладных морских и полярных исследований (фото слева). В соответствии с построенным по модульному принципу учебным планом в течение первых трех семестров осуществляется преподавание по шести модулям, начиная с естественнонаучных основ и заканчивая специальными знаниями. Вдобавок к этому студенты изучают иностранные языки и знакомятся с современными формами проведения занятий. Естественно, настоящему «помору» нужно поработать в Заполярье или на море. Осенью 2003 года студенты принимали участие в экспедиции на ледоколе в сибирское море Лаптевых и в экскурсии на станцию «Wissenschaftsdorf Ny lesund» на Шпицберген. Далее, в четвертом семестре студенты должны продемонстрировать в выпускной работе и на государственных экзаменах полученные знания и умения.

в экскурсии на станцию «Wissenschaftsdorf Ny lesund» на Шпицберген. Далее, в четвертом семестре студенты должны продемонстрировать в выпускной работе и на государственных экзаменах полученные знания и умения.



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> Finanzierung

> Финансирование

Der Aufbau des Masterprogramms

POMOR WURDE SEIT 2001 vom DAAD mit Mitteln des Programms "Export Deutscher Studienangebote" initiiert und finanziert. Beträchtliche Eigenmittel der Projektpartner haben den Studiengang mit auf die Beine gestellt. Da das DAAD-Programm sich als "Anschubfinanzierung" versteht, ist die Förderung regressiv und POMOR sucht Sponsoren. Für den laufenden Studienbetrieb sind vor allem Mittel für Honorare des russischen Stammpersonals, in Russland übliche Stipendien für die Studierenden, Dozentenhonorare und Reisen notwendig. Die Reisemittel, die einen bedeutenden Teil des Budgets ausmachen, werden benötigt, um ausländische Dozenten in St.-Petersburg lehren zu lassen, den Studierenden Feldarbeiten in den Polar- und Meeresgebieten und den Aufenthalt an einer ausländischen wissenschaftlichen Einrichtung zur Erstellung der Masterarbeit zu ermöglichen. Die notwendigen Ausgaben (ohne Eigenmittel der Projektpartner) für POMOR in den nächsten vier Jahren betragen ca. 200.000 Euro/Jahr. Diese Mittel können nur zum kleinen Teil von den beteiligten Universitäten und Forschungseinrichtungen erbracht werden. Daher sollen Ausgaben teilweise als Studiengebühren auf die Studierenden umgelegt werden. Patenschaften mit kooperierenden Firmen sollen Sponsorenmittel sichern, die POMOR zu Gute kommen. Die Studierenden können die Studiengebühren und Stipendien dann ihrerseits in begrenztem Maße über POMOR einwerben.

Perspektiven

DIE ERFOLGREICHE DEUTSCH-RUSSISCHE Zusammenarbeit des Ausbildungsprogramms soll schrittweise ausgebaut werden. Eine weitergehende Förderung der jungen Absolventen ist ebenso geplant, wie der jährliche Beginn eines Studienjahrgangs und die Einrichtung weiterer kooperativer Studienprogramme in ausgewählten Fächern.
Das wohl ambitionierteste Ziel von POMOR ist die Schaffung eines Netzwerks der kooperativen Aktivitäten Deutschlands an der Staatlichen Universität St.-Petersburg. Es soll sich neben der Unterstützung der Studienprogramme auch der Förderung graduierter Nachwuchswissenschaftler widmen, um die Förderung der deutsch-russischen Eliten in ausgewählten Wissenschaftsbereichen abzurunden und den beidseitigen Technologie- und Wissenstransfer zu etablieren.

Финансирование

POMOR WURDE SEIT 2001 с 2001 года поддерживала и финансировала создание и развитие магистерской программы «ПОМОР» из средств проекта «Экспорт немецких образовательных программ». Программе помогли встать на ноги и значительные денежные средства, вложенные непосредственно партнерами по проекту. Так как программа Немецкой службы академических обменов подразумевает стартовое финансирование, поддержка по этой линии сокращается, и «ПОМОР» ищет спонсоров. На данный момент для ведения учебного процесса необходимы прежде всего средства на зарплаты постоянному штату сотрудников в России, на стипендии, которые обычно выплачиваются студентам в России, на гонорары преподавателям и на покрытие транспортных расходов. Средства на покрытие дорожных расходов, которые составляют значительную часть бюджета, необходимы для того, чтобы иностранные преподаватели имели возможность вести занятия в Санкт-Петербурге, а студенты – вести полевые исследования в полярных и морских областях и побывать в одном из зарубежных научно-исследовательских институтов для написания магистерской работы. Для функционирования программы «ПОМОР» в течение следующих четырех лет необходимо изыскать сумму, равную примерно 200.000 евро в год, не считая собственных средств партнеров по проекту. Университеты и научно-исследовательские институты могут изыскать лишь небольшую часть этой суммы. Поэтому расходы отчасти придется взять на себя студентам и вносить плату за обучение. Договоры об оказании помощи с заинтересованными фирмами-спонсорами должны гарантировать поступление средств, которые пойдут на поддержку программы «ПОМОР». Тогда при поддержке программы «ПОМОР» студенты, в свою очередь, смогут изыскать часть средств на стипендии и покрытие платы за обучение.

Перспективы

НЕОБХОДИМО ШАГ ЗА шагом расширять успешное российско-германское сотрудничество в рамках данной образовательной программы. Планируется не только дальнейшая поддержка молодых выпускников, но и ежегодный набор студентов на эту программу, а также создание прочих совместных учебных программ в избранных областях.
Свою главную задачу в будущем «ПОМОР» видит в создании при Санкт-Петербургском государственном университете сети немецких организаций, заинтересованных в совместной работе с Россией. Наряду с поддержкой учебных программ задачей этой сети должна стать помощь молодым начинающим ученым – выпускникам, чтобы сделать поддержку российско-германских элит в избранных сферах науки более эффективной и содействовать двустороннему обмену технологиями и знаниями.

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> Russisch-deutsche Projekte im Bereich der Polar- und Meeresforschung: Forschung und Bildung in einem Konzept

> Российско-немецкое сотрудничество в области морских и полярных исследований: наука и образование в рамках одной концепции

DIE ZUSAMMENARBEIT ZWISCHEN russischen und deutschen Forschungseinrichtungen im Bereich der Meeres- und Polarforschung hat sich unter dem Dach der "Fachvereinbarung zur Zusammenarbeit auf dem Gebiet der Meeres- und Polarforschung zwischen dem russischen Ministerium für Industrie, Wissenschaft und Technologie und dem Bundesministerium für Bildung und Forschung" in den letzten zwölf Jahren äußerst positiv entwickelt. Nach einer ersten deutsch-russischen Expedition auf die Neusibirischen Inseln direkt nach der Perestrojka entwickelte sich schnell das gemeinsame Forschungsprojekt "System Laptev-See". In den Folgejahren wurden weitere Forschungsprojekte, wie z.B. "Kurilen Ochotskisches Meer Experiment" oder "Sedimentation im Elgygytgyn-See (NE-Sibirien) seit dem Pliozän" initiiert. Der Erfolg dieser Forschungsprojekte spiegelt sich in vielen gemeinsamen Expeditionen, Arbeitstreffen, Kongressen, einem regelmäßigen Wissenschaftleraustausch und vielen Publikationen wider. Um die Auswertung in den Forschungsvorhaben effizienter zu gestalten, wurde 1999 das "Otto-Schmidt-Labor für Polar- und Meeresforschung" eingerichtet. Seit 2001 wird die Wissenschaftskooperation mit den russischen Partnern durch den gemeinsamen Modellstudiengang »POMOR –Masterprogramm für Angewandte Polar- und Meereswissenschaften« erweitert. Die gute Zusammenarbeit im Forschungs- und Bildungsbereich beider Länder führt zur Vertiefung der guten Beziehungen zu beiderseitigem Vorteil in einem Bereich vergleichbarer Potentiale.

В ТЕЧЕНИЕ ПОСЛЕДНИХ 12 лет сотрудничество российских и немецких научно-исследовательских организаций в сфере морских и полярных исследований в рамках Соглашения о сотрудничестве в области морских и полярных исследований между Российским министерством промышленности, науки и новых технологий и Федеральным министерством образования и науки развивалось весьма успешно. После первой российско-германской экспедиции на Новосибирские острова сразу после перестройки стал интенсивно развиваться совместный исследовательский проект «Система моря Лаптевых». В следующие годы было положено начало дальнейшим исследовательским проектам, таким как «Эксперимент: Курилы – Охотское море» или «Седиментация в озере Эльгыгытгын (Северо-Западная Сибирь) с плиоцена». Успех этих исследовательских проектов отражается во множестве совместных экспедиций, рабочих встреч, конгрессов, в регулярном обмене научно-исследовательскими кадрами и многочисленных публикациях. Для более эффективного анализа данных, собранных в рамках исследовательских проектов, в 1999 году была создана Лаборатория морских и полярных исследований имени Отто Шмидта. С 2001 года научное сотрудничество с российскими партнерами расширилось за счет первой в данной области учебной программы «ПОМОР – магистерская программа: прикладные морские и полярные исследования». Такое плодотворное сотрудничество обеих стран в сфере науки и образования содействует развитию взаимовыгодных контактов в той сфере, где наши страны обладают сопоставимыми возможностями.

Pazifischer Ozean	Тихий океан
Ochotskisches Meer (S. 18)	Охотское море
Laptev-See (S. 14)	Море Лаптевых
Arktischer Ozean (S. 12)	Северный Ледовитый океан
Nordatlantik	Североатлантический регион
Elgygytgyn-See (S. 16)	Озеро Эльгыгытгын
Russische Föderation	Российская Федерация
St.-Petersburg	Санкт-Петербург
Europa	Европа
Kanada	Канада
Alaska	Аляска

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> Otto-Schmidt-Labor für Polar- und Meeresforschung

> Лаборатория морских и полярных исследований имени Отто Шмидта

DAS OTTO-SCHMIDT-LABOR FÜR Polar- und Meeresforschung (OSL) am Staatlichen Institut für Arktis- und Antarktisforschung in St.-Petersburg ist seit 1999 eine ideelle und logistische Basis für Forschungsvorhaben im Bereich Meeres- und Polarforschung. Vorrangig widmet es sich der wissenschaftlichen Qualifizierung und Förderung junger Nachwuchswissenschaftler. Im Mittelpunkt des wissenschaftlichen Arbeitsprogramms steht die Erforschung des komplexen Umweltsystems der sibirischen Arktis. Hier sollen natürliche Hintergründe, Auswirkungen und Rückkoppelungsmechanismen von kurzfristigen Klimaveränderungen erfasst werden.

ЛАБОРАТОРИЯ МОРСКИХ И полярных исследований имени Отто Шмидта при Государственнм научно-исследовательском институте Арктики и Антарктики в С.-Петербурге является с 1999 года идейной и материальной базой исследовательских программ в области морских и полярных исследований. Ее основной задачей является повышение научной квалификации и поддержка молодых начинающих исследователей. В центре научных работ стоит комплексное исследование окружающей среды сибирской Арктики. Задачей является в данном случае изучение природного фона, влияний и механизмов обратной связи краткосрочных изменений климата.

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> Die Laptev-See – Eine Schlüsselregion für das Verständnis von Umweltveränderungen ...

> Море Лаптевых – ключевой регион для понимания изменений климата ...

Russisch-deutsche Zusammenarbeit: System Laptev-See

DAS NORDPOLARMEER SPIELT EINE wichtige Rolle in der Klimaentwicklung unserer Erde, da es sehr schnell auf Umweltveränderungen reagiert und zudem aktiv an Steuerungsmechanismen des globalen Klimas beteiligt ist. Trotz mehrjähriger internationaler Bemühungen ist unser Wissen über die Prozesse, die das System Arktis heute antreiben und in der Vergangenheit angetrieben haben, begrenzt. Bisher ist es deshalb nicht gelungen, sichere Prognosen über die Auswirkungen von Klimaveränderungen im Nordpolarmeer, die auch Europa betreffen werden, zu stellen. Die Laptev-See als wichtiges Meereisproduktionsgebiet und das sibirische Hinterland als eines der bedeutendsten Süßwasserliefergebiete des Nordpolarmeeres stellen dabei wichtige Forschungsregionen dar. Im Rahmen des multidisziplinären Verbundvorhabens "System Laptev-See" werden seit 1993 natürliche Hintergründe, globale Auswirkungen und Rückkopplungsmechanismen kurzfristiger Klimaveränderungen in der sibirischen Arktis erfasst.

Российско-германский проект «Система моря Лаптевых»

СЕВЕРНЫЙ ЛЕДОВИТЫЙ океан играет важную роль в климатическом развитии нашей планеты, поскольку он очень быстро реагирует на изменения в окружающей среде и к тому же активно участвует в механизмах регулирования глобального климата. Несмотря на многолетние усилия ученых разных стран наши знания о процессах, управляющих арктической системой сегодня и управлявших ею в прошлом, ограничены. Именно поэтому до сих пор было невозможно дать точные прогнозы относительно влияний изменений климата в Северном Ледовитом океане, которые затронут также и Европу. Море Лаптевых (регион, где производится значительная часть ледяного покрова северных морей) и прибрежные территории Сибири, являющиеся одними из важнейших источников пресной воды в Северном Ледовитом Океане, представляют для науки значительный интерес. В рамках совместного междисциплинарного проекта с 1993 года исследуются природный фон, влияния и механизмы обратной связи краткосрочных климатических изменений в арктических регионах Сибири.

| Der Elgygytgyn-See
| Der Elgygytgyn-See

> Der Elgygytgyn-See – Ein Meteoritenkrater als Klimaarchiv

> Озеро Эльгыгытгын – кратер метеорита как климатический архив

Sedimentation im Elgygytgyn-See (NE-Sibirien) seit dem Pliozän

DER ELGYGYTGYN-SEE LIEGT im Zentrum eines vor ca. 3,6 Millionen Jahren durch Meteoriteneinschlag entstandenen Kraters. Aus der Zusammensetzung der am Grund des Sees abgelagerten Sedimente kann daher vermutlich die Klima- und Umweltgeschichte im nordöstlichen Sibirien seit der Entstehung des Sees rekonstruiert werden. Daraus werden wesentliche Beiträge zum Verständnis der Veränderungen in der Arktis bei der Intensivierung der Nordhemisphären-Vergletscherung vor ca. 2,6 Millionen Jahren und während der anschließenden, zyklischen Klimaschwankungen erwartet. Das Projekt soll die Grundlagen für die Erbohrung der vollständigen Sedimentfüllung im Elgygytgyn-See (NE-Sibirien) im Rahmen des International Continental Drilling Program (ICDP) erarbeiten.

Седиментация в озере Эльгыгытгын (С.-В. Сибирь) с плиоцена

ОЗЕРО ЭЛЬГЫГЫТГЫН НАХОДИТСЯ в центре кратера, возникшего в результате падения метеорита примерно 3,6 млн. лет назад. Поэтому по характеру отложений на дне озера можно с достаточной степенью уверенности реконструировать историю климата и окружающей среды на северо-востоке Сибири с момента возникновения озера. Результатом работы дожен стать существенный прорыв в понимании изменений в Арктике как при активизации оледенения в Северном полушарии примерно 2,6 млн. лет назад, так и во время последовавших затем циклических колебаний климата. Задачей проекта является разработка принципов бурения образовавшихся отложений в озере Эльгыгытгын (С.-В. Сибирь) в рамках международной программы ICDP (International Continental Drilling Program)

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> Das Ochotskische Meer Experiment

> Эксперимент «Охотское море»

Das Ochotskische Meer: Schlüssel zum Pazifik und zum globalen Klima

DAS OCHOTSKISCHE MEER IST das zweitgrößte Randmeer des Nordwestpazifischen Ozeans. Zusammen mit dem Kamtschatka-Kurilen-Inselbogen gehört es zu den vulkanisch aktivsten Gebieten der Welt, versorgt durch Nährstoff- und Zwischenwasserbildung als »Lunge« den Pazifik und dient – sieben Monate durch Eis bedeckt – als einzigartiges Modell für ein eiszeitliches Meer. Das Ochotskische Meer bietet die Möglichkeit, den Zusammenhang zwischen Bewegungen der Erdkruste einerseits, Erdbeben, Austritten des Treibhausgases Methan (Abbildung links) und Klimafolgen andererseits zu untersuchen sowie die ozeanographische und klimatische Evolution des größten Ozeans der Welt zu rekonstruieren. Das Gesamtziel des Projektes ist, die Mechanismen des komplexen, das globale Klima beeinflussenden Systems "Ochotskisches Meer" zu verstehen und dessen Einfluss auf Stoffverteilung, Stoffkreisläufe, Wassermassenbildung, Zirkulation und Klima zu untersuchen

Охотское море: ключ к Тихому океану и глобальному климату

ОХОТСКОЕ МОРЕ ЯВЛЯЕТСЯ вторым по величине окраинным морем северо-западной части Тихого океана. Наряду с островами Камчатско-Курильской гряды оно относится к самым активным в вулканическом отношении областям земного шара, это море снабжает Тихий океан образующимися в нем питательными веществами и переходными водами, являясь его «легкими», это море, покрытое в течение 7 месяцев льдом, служит единственной в своем роде моделью ледникового моря. Охотское море предоставляет возможность как для исследования связей между движениями земной коры, землетрясениями, выходом на поверхность болотного газа метана (фото слева), с одной стороны, и климатическими последствиями, с другой стороны, так и для реконструкции океанографической и климатической эволюции крупнейшего в мире океана. Конечная цель проекта заключается в понимании законов функционирования Охотского моря как комплексной системы, оказывающей влияние на глобальный климат, и в изучении его влияния на распределение и круговорот веществ, на образование и циркуляцию водных масс и на климат.

KONTAKT:

POMOR – Masterprogramm für Angewandte Polar- und Meereswissenschaften an der Staatlichen Universität St. Petersburg
Fakultät für Geographie und Geoökologie
33, 10.-Linie
199178 St.-Petersburg
Russland

Telefon/Fax: +7 8123-23-9976
secretariat@pomor.org
www.pomor.de

Deutsches Projektbüro:

POMOR – Masterprogramm für Angewandte Polar- und Meereswissenschaften
am Alfred Wegener Institut für Polar- und Meeresforschung
Postfach 12 06 01
27515 Bremerhaven
Deutschland

Telefon: +49 471 4831 1152
Fax: +49 471 4831 1102
ktuschling@awi-bremerhaven.de

АДРЕСА:

«ПОМОР»/«POMOR» – Магистерская программа прикладных полярных и морских исследований
при С.-Петербургском государственном университете
Факультет географии и геоэкологии
10 линия ВО, д. 33
199178 С.-Петербург
Россия

Телефон/факс: +7 812 323 9976
E-mail: secretariat@pomor.org
www.pomor.de

Координационный центр программы в Германии:

POMOR – Masterprogramm für Angewandte Polar- und Meereswissenschaften
am Alfred Wegener Institut für Polar- und Meeresforschung
Postfach 12 06 01
27515 Bremerhaven
Deutschland

Тел.: +49 471 4831 1152
Факс: +49 471 4831 1102
ktuschling@awi-bremerhaven.de

9. Exkursionsbericht -Spitzbergen

2003 Svalbard Science Odyssey

2003 Svalbard Science Odyssey

Edited by
Anastasia Moshkina
Dauren Khassanov

A special report, prepared by the
Master Program for Applied Polar and Marine Sciences
under St Petersburg State University, Russia
and University of Bremen, Germany.

This report presents the results of science practice during
2003 Svalbard Science Odyssey
and summarizes them for a wide readership.

2003 SVALBARD SCIENCE ODYSSEY

Contents

Foreword

The «2003 Svalbard Science Odyssey» Report is prepared by students of the Master Program for Applied Polar and Marine Sciences (POMOR). The articles were wrote during the practice and devoted to different aspects of work. They are following:

«History of Svalbard», by *Darya Vasilyeva* and *Irina Ivanova* gives a short overview of developing of land.

«The Svalbard Treaty», by *Dauren Khassanov* tells about legal practice prescribed at the territory.

«Mining at Svalbard», by *Irina Polovodova* and *Anna Nikoulina* introduce you the history of mining activities, companies.

«Geology of Svalbard», by *Maria Surovtseva* and *Julia Strelchenko* show you the history of geological past of islands.

«Ice conditions, Glaciers and Permafrost», by *Anastasia Moshkina* described important points of glaciology of Svalbard.

«Flora and Fauna of Svalbard», by *Olga Preobrazhenskaya* and *Anna Korobkina* draws a picture of unique nature of Svalbard.

«Protection of the Environment of Svalbard», by *Roman Smagin* acquaints with present activities and limitations keeps the environment sound.

Case study practice, by *Natalya Vaganova* in brief presents the possibilities in research work.

Also students introduce a joint message about activities during Ny-Ålesund campaign.

Needless to say, the authors remain solely responsible for any errors and omissions.

Acknowledgements

This study could not have been carried out without the support of Bremen University, St. Petersburg State University, the Alfred Wegener Institute for Polar and Marine Sciences and the GEOMAR Research Centre for Marine Geosciences whose offices directly responsible for this study.

In particular we appreciate for organization and guidance of Heidemarie Kassens and Kirsten Tuschling and theirs efforts in bringing this science practice.

We are grateful for making available the full range of facilities and extensive information that were readily provided by many colleagues at Koldewey-Station in Ny-Ålesund, Norsk Polar Institute in Tromsoe, UNIS in Longyearbyen.

Many colleagues at St. Petersburg State University, Otto Schmidt Laboratory for Polar and Marine Research provided advice and organizational assistance at various stages of preparation and we express our gratitude to them. In addition, we thank our POMOR team, especially Olga Safonova for dedicated help in preparing expedition.

1
Introduction

The Arctic is the first place that climate change is likely to be observed. The Arctic is experiencing significant change, which will have repercussions far beyond the region.

The Svalbard archipelago situated in the high Arctic, 1000 km from the North Pole between 74^0 and 81^0 N. Svalbard lies in the Atlantic portal to the circumarctic regions, at the northern end of the Gulf Stream's critical ocean/atmosphere heat pump. Shared scientific study of the Svalbard region, in the context of understanding past and present physical processes across the ocean/atmosphere/geosphere/biosphere system, is critical to understanding large climate and geophysical feedbacks on global scales. Svalbard is also the only readily accessible high-latitude site that underlies almost all geophysical phenomena triggered by interactions of cosmic particles with the Earth's magnetic field.

Svalbard is an excellent laboratory for studying the environment of the high Arctic because:

- Half of Svalbard's area is now protected as national park, nature reserve, plant protection reserve, or bird sanctuary;
- Svalbard's location offers access to Fram Strait, glacier fields, and other features that are important to global systems;
- It also contains relatively diverse animal and plant communities that are adapted to extreme latitude photoperiod and seasonality somewhat decoupled from extreme climate;
- Svalbard is the world's northernmost territory with modern research facilities and infrastructure.

Annually investigators from different countries conducted research on Svalbard, primarily based in Longyearbyen, the main municipality, and Ny-Ålesund, an international base for research in the natural sciences. The research efforts in Svalbard are complemented by an international educational programs, University of Tromsoe, University Centre on Svalbard (UNIS), a foundation which offers university-level courses in arctic sciences.

A multidisciplinary science practice was carried out in Svalbard area in September 3-21, 2003 in the framework of the joint Russian –

German educational program POMOR (Master Program for applied polar and marine sciences). This practice was initiated to increase Russian - German collaborations in conducting arctic research and exploring and using research infrastructure, provided by several European scientific institutions.

The objectives of practice were:

1. Improve the knowledge of the polar environment;
2. To get practical training on complex measurements of the local meteorological properties during Ny-Ålesund campaign;
3. Study of presents research activities, ongoing projects and recognising of potential research topics.

In order to organise research activities it was divided into three parts:

1. Exploring of specific theoretical topics by each participant;
2. Three small working groups were organised for visiting Ny-Ålesund station;
3. Field work, excursions and case studies of range of disciplines, including geology, biology, paleogeography, ice conditions of Svalbard.

2
Science work

2.1 The History of Svalbard

Fig.1 W. Barents's map issued in 1598. There was the first outline of Archipelago. UoT

The name Svalbard means the cold coast or edge and was first mentioned in Icelandic annals from 1194. The first discoverers were Vikings. However, it is uncertain whether the geographical locality refered to here was part of what we think of as Svalbard today. Also some historians consider that Vikings weren't the first discoverers of Svalbard, because there is no evidence of their ever presence in Svalbard.

After Vikings Svalbard could be visited by Pomors (people from White Sea region). A Russian hypothesis claims that they had huts and hunted on the west coast of Spitzbergen during the XVI century, perhaps even the XV century. There are numerous written sources to can evidence in support of early Russian mariners' voyages to

Spitzbergen which was marked in papers as Gruland or Engroneland. This name was rendered in the Russian North as Grumant and existed there up to the XX century. And much earlier this land was called by Pomors as Maksin Island. However, some specialists are sceptical, thinking that so many aspects of the evidences are dubious. As for archaeological monuments there are remains of five wintering hunting stations of early Pomors's activity time only of middle-second half of XVI century. Also it is necessary to note that there is different opinion about first discovers of Svalbard between European and Russian historians. One of them consider that Vikings were the first, others think that Pomors were the first discovers.

Anyway the official discover was Dutch Willem Barents who landed on Svalbard in 1596. With two ships, Willem Barents set sail that year to seek a short cut to China along the unexplored northern coast of Asia. On the 9th of June his ships reached an unknown island far to the north. There the sailors killed their first polar bear, and island was named Bear Island. On the 17th of June they sighted another, much larger land, with high snow-capped mountain peaks, and this they called Spitzbergen, from the formation of its mountains. A part of archipelago was outlined with coordinates after Barents's sail to Spitzbergen.

In the beginning of the XVII century the English Henry Hudson revealed that the waters around Svalbard were very rich in whales. When his discovery became known in Europe a very active whaling period commenced along the west coast of Spitzbergen and lasted to the middle of the XVII century, at which time the whales were nearly extinct. Svalbard was then left deserted until Russians from the White Sea started to over winter for polar bear and fox trapping during the XVIII century.

The people of north Norway learnt about the possibilities of Svalbard from these fur trappers. From the beginning of XIX century Norwegian hunting and sealing were predominant activities on Svalbard.

For the first 300 years, the universal occupation was hunting, until cool mining took over at the beginning of the XX century. This resulted in permanent settlements in well-organized communities.

Bell Sound. An old whaling station. A "monument" over the tragic fate of the Beluga whales. (Photo: Kjell Germeten http://www.germeten.no/photo/foto-htm/ph_arc02.htm)

As it was sad above Russian (Pomors) whaling and prey flourished in XVIII century. As per papers of Archangelsk province chancellery about 200 fishing boats used sailing to Spitzbergen every year and learning more that 2000 people for wintering there. Ivan Starostin was the most famous Pomor who used living there and whose name got into the place-names book of Spitzbergen. The first time Ivan Starostin visited Spitzbergen in 1780. He used coming here from time to time spending more and more time there. And in 1811 he decided to make Spitzbergen his home and settled up on Linne River bank. His being in Spitzbergen totaled 39 years out of which 32years included wintering. He perished in his house in 1826 after continuous living there for 15 years. Starostin's name naturally worth to get into Spitzbergen map. On the proposal of prominent Arctic explorer A. E. Nordenskiöld the big cape close to Russekeila was named after Starostin. There is also Starostinskaia (Starostin ridge) at the back of Kapp Starostin and Starostin fjellet (Starostin mountain peak) on the south side of Hornbreen, East of Horsund.

The whaler's "summer cabin". (Photo: Kjell Germeten http://www.germeten.no/photo/foto-htm/ph_arc02.htm)

Scientific activity commenced in Spitzbergen in the second half of XVIII century. Russian vessels entered Recherchefjorden in 1746. This was the first team of marine expedition under command of Vasiliy Chichagov. They intended to make a base and a wintering camp for the expedition. The idea of such expedition belonged to Michael Lomonosov who mad an attempt to find the shortest way to the Pacific Ocean. This was the first Russian expedition to the North Pole.

In XIX century Svalbard is regularly visited by expedition from Norway, Sweden and other countries. In 1827 Svalbard was visited by Norwegian geologist Baltazar Mathias Keilhau who collected a good deal of information on nature and history of the archipelago. Valuable scientific material on Svalbard geologic structure, flora and fauna was collected by Swedish expedition headed in 1858, 1861 by geologist Otto Martin Torell and in 1863 by archaeologist and mineralogist Adolf Erik Nordensjöld who made a survey of the archipelago shores and a new map of Svalbard.

In 1899-1901 the first Arctic international expedition carried out research works in Svalbard. This was Arc-of-Meridian expedition to Svalbard. Many prominent scientist from Sweden and Russia took part in that work. During three field work seasons the survey points system was established at the distance of 460 km, 1123 barometric heights were measured, geomagnetic survey, aerography and other works were carried out.

In 1899 the first in the world Russian icebreaker "Yermak" leading by admiral Makarov approached Spitzbergen. Within two summer seasons the expedition carried out hydrographic works of great importance. They erected in Adventifjorden so called "secular mark" – a stone pyramid to register ocean level changes at different times.

Svalbard Archipelago appeared to be the last area of activity for remarkable Russian Arctic explorer Vladimir Alexandrovich Rusanov. In 1912 Russian expedition under his leadership investigated about two thousand kilometers of coastline and erected 27 claim points for coal deposits.

Since 1909 every year Norwegian research expeditions headed by prominent Arctic explores F. Nansen, R. Amundsen, O. Sverdrup, W. Werenskjold, G. Sachsen and others set off to Svalbard.

From 1924 up to 1941 the first Russian specialized maritime research vessel "Perseus" carried out explorations in Spitzbergen region.

In first half of XX century Spitzbergen (Ny-Ålesund) also used by famous pilots as the base for a flight to the North Pole.

In 1926 Roald Amundsen, accompanied by the American Lincoln Ellsworth and the Italian Umberto Nobile, set out on a joint expedition in the airship "Norge". The historic expedition was a success. As planned the airship flew over the North Pole and landed in Teller, Alaska. Two years later, Nobile left Ny-Ålesund on another polar flight, this time with the airship "Italia". The expedition reached the North Pole, but on its return flight it encountered serious icing problem, failed to maintain sufficient lift and fell onto the drift ice. Half the 16-man crew perished. Amundsen died during a flight northwards to join the search for the missing expedition members.

2.2 The Svalbard Treaty

Since the 1600s people from several nations have carried out various activities on Svalbard, such as hunting and fishing, research, mining and tourism. For years these activities took place without the region belonging to any particular state – Svalbard was a kind of international common ground, which meant there were no any laws or regulations. Subsequent legal relationship is illustrated at the following table.

1872	For the first time legal status of islands by the *Agreement* in the form of an exchange by notes between Russia and the United Kingdom of Sweden and Norway was determined. The Agreement equality of all countries admitted operation of natural resources and production of research works.
1910,	In connection with growth of economic and strategic significance of archipelago there was a necessity to specify

1912, **1914**	the points of 1872 Agreement, and to establish an administrative - legal order. As a result of conferences work of three states - Russia, Norway and Sweden the *Project of the Convention* was working-out. It was emphasised, that Russia and Norway have rights of priority before other countries in definition of the international legal statement of Spitzbergen ".... by virtue of affinity of their territory and by virtue of their sharing in opening and scientific research of these areas and proceeding from their economic interests". USA and Germany aspiring by any way to limit these rights and simultaneously to be fixed on archipelago, have broken acceptance of the Convention on Svalbard in 1914. Because of the begun first world war conference could not finish the work.
1920 **Paris**	Without participation of the Soviet Russia representatives of the Great Britain and its five dominions and a colony, Holland, Denmark, Italy, Norway, France, USA, Sweden, Japan have signed the agreement for transfer of archipelago under the Norway sovereignty. The agreement has obliged Norway to enter the *Mining Charter* on Svalbard and has defined its main principles. According to these principles any privileges, monopolies or privileges both for the benefit of the state, and for the benefit of citizens of one of countries - participants of the Agreement, including Norway are excluded. The Mining Charter has come into force in 1925.
1924	During negotiations with Norway Soviet Union has recognised sovereignty above archipelago.
1935	USSR officially has joined the *Svalbard Treaty*.

The Svalbard archipelago, including island Bear, according to the Svalbard Treaty from February 9, 1920 is under the complete and absolute sovereignty of Norway on the conditions including as a substantive clause the right of other parties of Treaty and adjoint states on development of resources of archipelago and its territorial waters (Article 1). Hence the sovereignty of Norway above Svalbard is limited and stipulated by confession of rights of other states.

To citizens, whose states have signed the Treaty, the right to be engaged was given by fishery and hunting to acquire and develop deposits of minerals on equal conditions with Norway. Especially in the Treaty it was noted, that Norway is obliged to not create and to not suppose creations of any marine base on Svalbard and also to not build any strengthening which could be used in the military purposes. Logically also is founded in law to approve, that confession of these rights is distributed also to a continental shelf and the exclusive economic area of Svalbard.

To clauses of Treaty are contradicted obviously with actions of Norway government which has declared exclusive sovereign rights for a continental shelf of Svalbard, and June 3, 1977 has made the decision on establishment of a 200-mile fishing zone around of it. For the substantiation of these claims affirmed, that: a) according to the Svalbard Treaty it is distributed Norwegian sovereignty; b) in the Agreement there is no article limiting the right to establish around of this part of state territory a zone of the national jurisdiction (a shelf, fishing or the economic area); c) the item. 2 defining the equal right of citizens of countries - participants of the Agreement to conduct fishing in territorial waters of Svalbard, is not distributed for external (4 mile) limit. Such interpretation of the Svalbard Treaty and its legal effects concerning an economic (fishing) zone has created legally illogical and extraordinary situation when the foreign fishing can not be forbidden within the limits of territorial waters of Svalbard, but can be excluded within the limits of a 200-mile zone of the functional (resource) jurisdiction outside these territorial waters, and Norway opposite, can have in a zone such rights what it has no in territorial sea and on land, i.e. in the spaces delivered under it sovereignty on certain conditions.

Understanding legal insolvency of such arguments, diplomats resorted to roundabout measures, approving, that now Norway will refrain from establishment in a zone of rights of priority for the fishermen and will be limited to regulation of fishing without discrepancy between the Norwegian and foreign fishermen. In the attitude of a shelf one time the argument was put forward, that islands of archipelago lay on continuation of a continental shelf of Norway and consequently it is necessary to speak not about a shelf of Svalbard, and about a "common" shelf of Norway, including its continuation from archipelago. Attempts to bypass the condition of the Svalbard Treaty providing the equal right of all participants on economic use of archipelago and, hence, adjoining zones, are in the obvious contravention with obligations which were undertaken with Norway. The acting Convention on a continental shelf of 1958, the Convention

of the United Nations under the maritime law of 1982 do not give any legal the basis for withdrawal of a shelf or an economic (fishing) zone of Svalbard from under action appropriate the clauses of Svalbard Treaty. Legally Norway cannot use on a shelf and in a zone of Svalbard by bigger volume of rights, than on the archipelago, and can not appropriate the rights belonging in a zone to all participants of the Svalbard Treaty.

Especially it is necessary to stay on questions of delimitation of zones of the functional jurisdiction - the exclusive economic areas and a continental shelf between the states with opposite or adjacent coasts. In Arctic regions it first of all dispute continuing many years with Norway about delimitation of marine borders in Barents sea, including questions connected to interpretation of the status of Svalbard archipelago. For example unsolving of the given question raises barriers on the way development Shtokman deposit. It is in a conflict area for which applies both Russia and Norway. Unsolving of differentiation problems frightens off potential investors from an investment in its development. Acceptance of more flexible approach at delimitation with Norway has opened possibilities for search of the mutually acceptable agreement. Now acts "frozen" status quo with a mode disputable "a grey zone" and preservation of the status of Svalbard. Becomes development of the alternative concept of the decision of dispute more and more obvious necessity.

2.3 Coal Mining on Svalbard

Coal bearing series locate mainly on island West Spitzbergen especially:

- Western coast of Spitzbergen
- Central and southern parts of Spitzbergen
- Eastern part of Spitzbergen
- Islands of the eastern part of Spitzbergen
- Bear Island

In 1980s there were 34 coal objects including 18 districts, 9 fields and 7 coal bearing areas.

This coal was generated in depth from higher plants such as oak, cypress, poplar, magnolia, pine, fir, palms and also tree ferns. Coal bearing sedimentary were formed in Precambrian, upper and low Palaeozoic and Mesozoic epochs. The main coal bearing rocks are coal, conglomerates, gravelites, sandstones, siltstones, claystones, coaly sedimentary and concretionary formations of siderites.

History of Coal mining

Since 17th century whalers knew about existence of coal at Spitzbergen. Hunters, different expeditions and other visitors also have exploited these resources. English fisherman used the coal for extracting of the whale blubber. Among first pioneers of coal exploration was sailor Soeren Zachariassen from Tromsoe. At 1899 he extracted coal at Istfjorden and brought it to Tromsoe for sale. Later people, who travelled Svalbard were looking for coal, marble, gypsum, gold, iron and other minerals. However the commercial developing of resources began only in XX century, when American, Holland, English-Russian and Sweden companies exploited the coal deposits.

At that time commercial interest was centred on coal due to next reasons:

1) Domestic heating lead to development of the huge market for coal industry in Europe.
2) Growing fleet of steamers.
3) Ever-expanding railway networks.

As a result of this the several coal mining companies were established and coal resources on Svalbard began to be explorated seriously.

In 1900 a first Norwegian coal-mining company - the Kulkompaniet Isefjord Spitzbergen - started its activities on the islands.

Soon afterwards other companies from different countries joined, the most important being the *American Arctic Coal Company* (ACC) established in 1906 by two businessmen from Boston: Frederic Ayer and John M. Longyear, which purchased the rights to coal deposits in Adventdalen from Trondheim - based company. This company began mining operations in Longyearbyen. In 1916 the ACC sold its properties to the new *Store Norsk-Spitzbergen Kulkompagni* (SNSK - Great Norwegian-Spitzbergen Coal Company), which after WW I became in fact the only mining company present, the U.S.S.R. mining trust excepted[1].

The presence of different nations and the ensuing conflicts over mining grounds on the islands did arise the question of the ownership of Svalbard, which till then had been a "terra nullius".

[1] Most foreign companies all abandoned their camps and mines after 1918. The last to go was the Swedish Spitzbergens Kölfelt Company, which, in 1934, sold its properties to the SNSK. The only other remaining country was the U.S.S.R., which in 1926 - 1932 bought Dutch and Swedish mines. These mines were exploited by Trust Arktikugol - a Soviet public corporation - and were under the supervision of the Soviet consul at Barentsburg.

At the same time the SNSK toke a large part in the administration of the islands, issuing its own currency and purveying the islands with their first social institutions (a church, a hospital and a school.

The problem was solved in 1920 when, by the *Svalbard Treaty*, the sovereignty of Norway over Svalbard was recognized, the other nations receiving equal rights to exploit the economic resources of the islands. The treaty came into effect in 1925 and the islands became part of Norway.

During the Second World War the mining plant at Longyearbyen was decommissioned in the summer of 1941 and the population was evacuated. The islands achieved military significance in connection with vital convoy traffic to the parts of northwestern Russia, both as potential base for planes and warships and as link in a chain of meteorological stations necessary for preparing weather forecasts.

During the summer of 1942 until the end of the War the allies maintained small groups in Svalbard. They were chiefly comprised of Norwegians and had their main bases in Barentsburg and Longyearbyen. Substantial losses were suffered during German attacks from the air (May 1942) and the sea (September, 1943). After War most of the mining plants had been destroyed but soon began to rebuild. SNSK modernized and extended its *plants in Longyearbyen and in Sveagruva*, the mine at the head of Van Mjienfjorden began to produce the coal again.

Mining at Sveagruva soon stopped but its development was taken up again in 1970. The shipping of coal from Sveagruva is, however, seriously hampered by the difficult ice conditions in the fjord.

Plans for road to Longyearbyen have existed for a long time but this is a very controversial project because of fears for the negative consequences a road will have on the environment.

Large coal deposits were revealed just north of Sveagruva and were called Setralfeltet (the Central Field). A number of drill cores have recently been acquired there with a view of determining the basis for future working. For a long time SNSK extracted around 400 000 tons of coal per year, but from the end of the 1980s dropped to approximately 300 000 tons and was only just over 200 000 tons in 1996.

The English whale hunter Jonas Poole dicovered the first pieces of coal on the southern banks of Kongsfjord in 1610. Another threehundred years were to pass before commercial exploitation of the coal deposits in the area commenced, when Peter S. Brandal - a Polar Sea captain - needed coal to fuel his steamships during the first World War. In 1916 Norwegian firm *King's Bay Kull Company* laid the most northern coalmines and founded town Ny-Ålesund in latitude 79 N. However there were several accidents and exploration of coal resources had a poor profitability. So, operations stopped in 1929. Company

became state-owned in 1933 and after the War plant was renovated and coal production began again. But several explosions were occurred at mine in 1953 and production of coal was decreased. Again full production was achieved at 1961. But in November of 1962 major explosions took place at the mine and there was a loss of 21 lives. This led to permanently decision to cease the mining operations in account of excessively dangerous conditions. Finally, these mines were closed in 1962 due to the large explosion of methane. Later Ny-Ålesund became the centre for the new kind of activity and today it is a centre for international arctic scientific research and environmental monitoring.

The Russian mines at Barentsburg, Grumantbyen and Pyramiden were also rebuilt and put into production again after the War in this case by the Russian State-owned mining company Trust-Arktikugol. The mining at Grumantbyen ceased to be worked at 1962. In recent years the two remaining Russian mines have together produced about 500 000 tons of coal annually.

It was considerable interest during 1960s for possible oil deposits in Svalbard and several companies secured prospecting rights. The activity probably peaked in 1965-66 when a borehole was drilled down to a depth of 3,5 km at Van Mijenfjorden. But neither then nor other boreholes have so far revealed exploitable discoveries and there's now little activity in this field.

Now there are only two companies: Norwegian Store Norske (Store Norske Spitzbergen Kulkompani AS) (Longyear and Svea fields) and Russian Arctic Ugol (Barentsburg and new Colesbay).

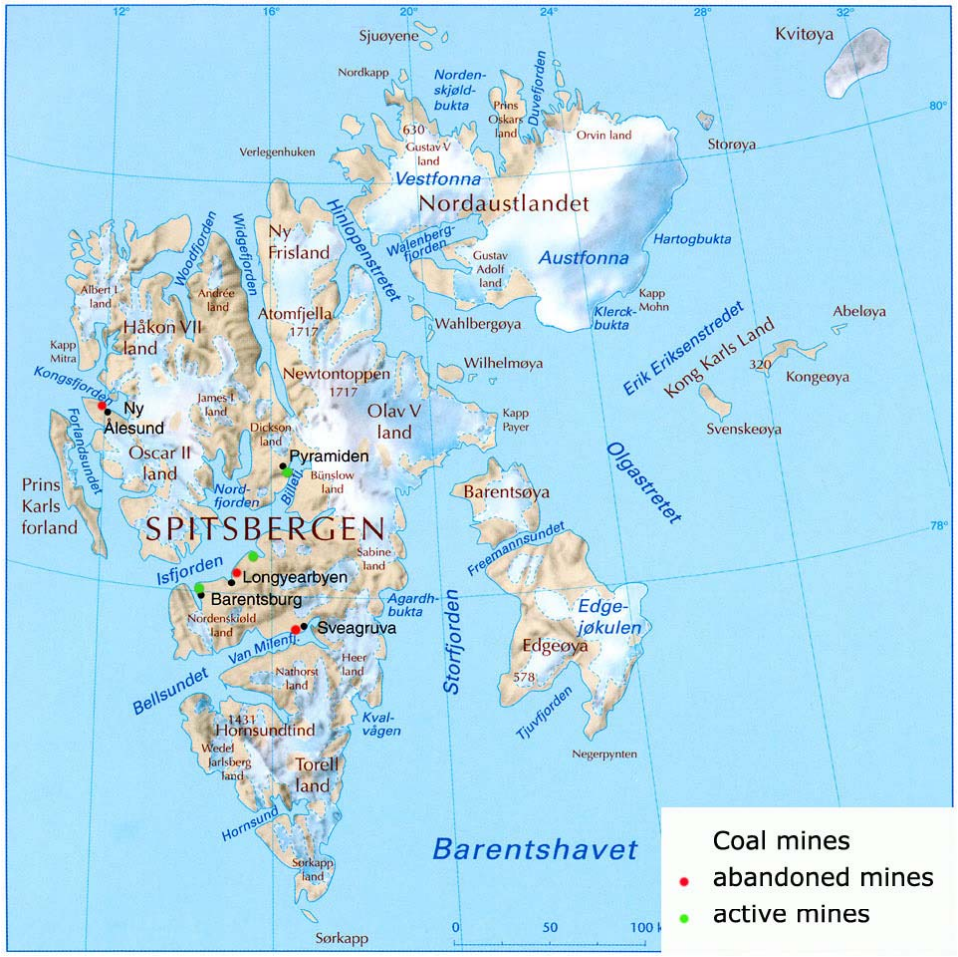


Fig.2 Coal mining at Svalbard

Store Norske Spitzbergen Company

The entire production of Store Norske was sold to Norwegian costumers. Coal was at the time an important source of energy in Norway. Approximately 1.5 to 2.7 million tonnes of coal was imported annually. In comparison, today's import amounts to approx. 2 million tonnes of coal and coke annually.

At the beginning the company implemented an expansion policy, and the work force was increased steadily. In all matters, the company had to base its actions on self-sufficiency and self help. More than 40 different job categories were offered by the company, and in 1949, the company employed 1,308 people. The class society at the time was very organised. Almost whole settlement Longyear was belonged to the SNSK but later Report no. 50 to the Norwegian Parliament 'Stortinget' (1990-1991), stipulates a decision to open Longyearbyen to more

people, and indicates that society was to be deliberately changed from a company town to a more conventional family society. But Store Norske remained to be responsible for the supply of provisions, and dried food was handed out once a month on the basis of prior requisitions. The company stopped selling provisions in 1992 when private companies took over this business endeavour.

On a company initiative, a decision about reorganisation was made in connection with proposition no. 61 to the Norwegian Parliament (1986-87) to separate the company from the community tasks. The reorganisation took place in cooperation with representatives chosen by the employees, and no conflicts arose.

Store Norske owns 2,006 km^2 of treaty property on Svalbard covering six properties. The property Longyeardal is most the important one since this is where the Norwegian main settlement is located. As a property owner, the company is responsible for the planning of the local area, and has hired its own environmental workers to work with the clean up and maintenance of cultural monuments. The working relationship has developed over time in close cooperation with the District Governor on Svalbard.

Store Norske has carried out prospecting for minerals and oil for a long time, and has entered into cooperation agreements about this with other companies such as Amoseas Caltex (1960-78) and Norsk Hydro AS (1985-1995). The company has also participated in two sample drillings for oil, but no profitable deposits were discovered.

Mining in Longyearbyen

In Longyearbyen, the basis for production has always been the Longyear seam throughout the years. This is a coal layer measuring from 90 to 190 cm. The coal layer inside the mountain, which is layered like the filling in a layer cake, is known as the seam. In Svea, the seam is simply known as the Svea seam, and the size of this layer is up to five metres.

The coal was transported from the production site to the silos by the mine by train. In earlier times, this was also done by horse-drawn buggies. In the current mechanised mines, the coal is transported by conveyor belts. The mines in Longyearbyen have been opened in the hillsides, and mountain elevators have been installed to lift materials and staff up and down to the mines. Back in time, the coal was transported from the mine by aerial ropeways leading down to the cleaning and loading plant. The aerial ropeway in Longyearbyen was discontinued in 1987, and the coal is currently transported by truck.

In 1916, Store Norske enjoyed a very good start on its production and shipping activities. In addition to mining in mine no. 1, the company initiated preparatory development work in mine no. 2. The coal prices were high, and the company achieved a profit on operations. However, during the night of 3 January 1920, a coal dust explosion took place in mine no.-1, and 26 people died. Of these, four were buried in the cemetery in Longyearbyen, which was consecrated on 13 July 1919.

The operation of mine no. 1 was cancelled. By then, 124,000 tonnes of coal had been extracted. Subsequent research shows that the: explosion was caused by blasting inside the mine. After the fire was extinguished, the majority of the equipment was used a mine no. 2.

The coal was shipped to Norway, and there were rarely problems with the ice conditions. Store Norske also fitted boats from other coal producers with bunkers. The ships could not get up steam with the coal they were shipping, but the Longyear coal was of a fine quality.

The company expedited the preparation of mine no. 2, and in 1922, the mine was in full production. Up until 1926, the production was increased to approx. 200000 tonnes of coal annually, and towards 1940, it was increased to 300,000 tonnes annually. Between 1920 and 1930, the coal prices dropped by 60% worldwide. The company managed to reduce costs by 30% during the same period of time, but nevertheless faced financial difficulties, and thus entered into a debt rescheduling scheme with the state. In return, the state was entitled to rent company land for free.

In 1937, a new plan was made for mine no. 2, and the production continued until 1941 when the residents of Longyearbyen were evacuated because of the Second World War. The mine was set on fire by the German battleship "Schamhorst" in 1943, and continued to burn until 1962. After the war the fire was isolated, and operations continued until 1967/68. The preparatory development work of mine no. 4 was initiated in 1954 and in 1956/57, a major bridge was completed which connected mine no. 4 to the infrastructure of mine no. 1 across the valley Tverdalen. In 1959/60, the preparatory development work was expedited so that the mine became a reserve mine in 1960. The coal was removed through the transport system in mine no. 2. The mine was discontinued in 1970.

The development work of mine no. 5 was started in 1956. This mine was the first one to be located outside Longyearbyen itself. The production started in 1959, and this mine was depleted in 1972.

The entrance tunnel for mine no. 6 was extracted in 1965, and the equipment work was commenced, and in 1969, production started up.

The production in this mine was discontinued in 1981 without the mine being declared depleted. The equipment and tools still remain within the mine, although it was declared depleted in 1994. It is under judgement as a cultural monument.

In the 1969/70 year of operation, the preparatory development work in mine no. 3 was initiated, but as early as 1928/29, the coal deposit there had been discovered. The regular production was started in 1972, and the mine was depleted in 1996.

In 1964/65, the coal deposits of mine no.7 were investigated. At the time, this mine belonged to the state owned company AS Adventdalens Kullfelt (the Coal Field of the Advent Valley, Ltd.). The state had previously performed surveying work in relation to the mine, where the development work was initiated in 1966.

Store Norske acquired the mine in 1977, but the mine was not entered into regular production until 1975/76, when approx. 120.000 tonnes of coal were produced annually. The operation has now been reduced to 50.000 tonnes annually, and on the background of known reserves, it has an estimated lifetime ending in 2010. The operational method is Rom & Pillar. The coal is mainly sold to the coal-fired power station in Longyearbyen.

Mining in Svea

Store Norske bought Svea from the Swedish company Nya Stenkolsaktiebolaget Spetsbergen in 1934 (the New Swedish Coal Company Spitzbergen, Ltd.). The Svea field was surveyed during the first years after the Store Norske acquisition. Store Norske did not initiate any kind of production before the war, and the equipment was indeed destroyed during the war. After the war, Store Norske ran a small production here, but problematic operation conditions in connection with the coal layer resulted in the mine being closed in 1949. Surveying was still carried out, and in 1956/57, a test gallery was initiated in Svea Øst.

Up until 1977, there was only very little equipment in Svea. Several of the remaining houses from the 1946-49 operation period were used as storage, workshop and power station buildings until 1977, when permanent equipment was installed for these purposes. From 1983-87, the equipment was upgraded for larger production in Svea. New housing, dressing equipment, storage facilities and workshops were constructed, the quays and electric power supply facilities were improved, and the mine was upgraded. For financial reasons, operations of Svea, were suspended in 1987, and subsequently, this

mine has only been used for surveying purposes with a production of approx. 20,000 tonnes annually.

In 1995, the Norwegian Parliament decided that the production in Svea Vest could be restarted, and in 1996, the mine and its equipment were rebuilt. Production started up in 1997, and the operational method consisted of CM machines for the preparatory development work and a longwall stope for the production.

Right outside Svea there is a large coalfield containing approx. 30 million tonnes of commercial coal. This field is currently being surveyed with the purpose of finding out if mining it is a viable solution. All surveying is carried out in such a way that the surveying results and the work performed can be used in future mining operations. The new mining field is called Svea Nord.

Modern coal mining

Coal is to a large extent used as a raw material in energy production world wide, and it is part of the product range, which the energy nation Norway offers other countries. Similar to the other raw materials, the price trend of coal is on the decrease. Efficiency, simpler production methods and a better infrastructure will thus be of decisive importance to the economy in a coal company.

The principle of stope operations can be illustrated as seen in the figure to the right. The green lines how stopes which are run into the field in order to prepare the stope production. The yellow fields illustrate the stope panels.

The coal is mined, transported out of the mine, and loaded onto trucks to be taken to the storage facility by the lake. In the shipping season from mid-July to mid-October. The coal is shipped out of the customers.

The field of operation has been located in such a way that dirt-band are avoided. This means that it is not necessary to clean the dressed coal, and deposits of separated rocks are thus avoided. These factors contribute to the reduction of the negative local effect on the environment, which the coal production has.

Mining machines and methods

The Continuous Miner (CM) is probably the most important work tool in mining. This machine is used to open up a field and to prepare the field for the stope production. The machine can also be used in the actual production, and the type of operation will then be known as Rom & Pillar. This type of operation is efficient in geologically unsettled

fields. It does not render the same profit ratio and is more cost-consuming than stope production.

The coal is cut and then placed on a shuttle car, which takes it out to the conveyor belt system to be transported out of the mountain. A CM requires a work team of 12 people.

The operators stand underneath the secured roof and operate the machine remotely. When a 10 meters cut into the seam has been completed, the machine is moved to the next tunnel. A bolt rig is then placed in the first tunnel to secure the roof, and the work proceeds like that in a steady pace.

Mechanised stope production is the most efficient production method, and requires a work team of eight people. As it appears from the drawing, a stope consists of large hydraulic cylinders with steel shields to support the mountain. The operators are located underneath this shield support, where they are well protected. In front of the shield support there is a cutting machine, a breaker and belts. When the coal is cut, the hydraulic cylinders are moved forward. Behind the shield, the roof enters into a goaf, and this method of operation is thus also known as controlled goaf.

Health, environment and safety should always form an important part of operations in a mining company. The protection equipment must be updated frequently, just as new security regulations should be adopted regularly. On-the-job training is also a significant part of the work. During recent years, most miners have taken trade test certificates.

Cooperation partners in transportation and on the market

The mined coal is transported to the loading dock at the quay. The transportation department was separated into a company of its own in 1999, and this company started co-operating with the construction company Leonhard Nilsen & Sønner AS (Leonhard Nilsen & Sons, Ltd.). The new company is called Leonhard Nilsen & Sønner Store Norske AS. The shipping season in Svea is about 100 days starting in mid-July. During this period, all the coal is shipped out, and cargo is shipped in. The coal from Svea is mainly used for energy purposes, and is sold on the European market. There is no problem selling all the coal through the partner SSM Coal and Coke GmbH and our jointly owned sales company Store Norske Intercoal AS.

Cooperation on Svalbard

Store Norske has initiated a research and development co-operation with UNIS and Norsk Polarinstitut (Norwegian Polar Institute) on Svalbard. Through this work, it is expected that the mining operation solutions which the company chooses must have the least possible negative effects on the natural environment.
Store Norske has also started co-operating with the environmental department of the District Governor's Office of Svalbard. This work mainly relates to the management of the cultural monuments.

Coal at the energy and power market

The largest exporters are Australia, USA, South Africa, Indonesia, China, Poland and the countries in the former Soviet Union. All these countries produce from 200 million tonnes to 1.3 billion tonnes of coal annually. In comparison, Store Norske will produce approx. 1.2 million tonnes of coal annually, which corresponds two thousandths of the world production.

The largest importers are Japan, Korea, Taiwan, Holland, Germany and England. These countries import from 20 to 130 million tonnes of coal annually. In comparison, Norway imports approx. 2 million tonnes of coal annually.

When coal is mined, methane escapes. Average emission values are 20-30 m^3 methane for every mined tonne of coal. On Svalbard, the coal layers are located in the sides of the mountain, and have only little coverage as well as a lower mountain pressure than underground mines. The rock types there are porous, and methane in the coal layers thus escapes freely. The average value of methane emissions from the mining activities in Longyearbyen is 0.9 m^3 per tonne of coal. This results in a methane emission of 0.00065 tonne per tonne of mined coal. Converted to CO_2 equivalents seen in a 100-year perspective, this results in 0.0136 tonnes of CO_2 equivalent per tonne of mined coal.

The production of primary energy has been increased by approx. 50 % in the period from 1973 to 1996. During the same period fossil primary energy CO_2 combustion emissions have increased by 40%.

Coal is mainly used in the energy production in coal-fired power plants and for the cement and metallurgic industries.

Store Norske prepares an environmental report which gives a more detailed description of the environmental challenges in connection with the production and coal usage seen both from a national and international perspective.

Informational and tourist attraction

The mine no. 3 in Longyearbyen is currently used for informational tours for tourists. The District Governor has assigned funds to keep mine no. 3 open as a cultural attraction. It was the last mine on Svalbard where coal was mined by hand in narrow shafts. Here tourists can dress themselves up in an overall, belt, helmet, gloves and headlamp before setting off into the mountain for getting the feeling of real miners.

List of coal mining terminology

Continuous Miner (CM) - Belt-driven electrical production machine. Used for the development work, gallery operation and in Rom & Pillar operations. Store Norske uses remotely controlled machines to allow the operators to stand underneath a secured mountain when they work.

Seam - Coal layer limited by other rock types above and beneath it.

Fault - Rock types, which due to movements in the earth's crust are exposed to forces so great that they crack. The plates thus become displaced in relation to each other. The crack and displacement is called a fault.

Conventional stope - A stope which is run in an "old-fashioned" way in which the coal is excavated from the mountain by using explosives.

Mechanised stope - Compared to production using a conventional stope, coal mining by a mechanised stope takes place by using machinery. The most important machines are a roller cutting machine which cuts the coal off the face, and hydraulic cylinders to support the mountain and keep it up while the work is carried out.

Dirt band - Rock layer, which divides the coal seam. It may be a single or several rock layers, and the thickness varies. Mellomstein pollute the coal.

Dressing/cleaning - Dressing is where the rock is removed from the coal, so the right quality is obtained. The coal is sieved and crushed until it gets the desired size (quality) before it is passed through more cleaning machines. Rocks are separated, and the finished coal is transported to the loading plant so it is ready for shipping. The coal is stored separately in accordance with quality and size, different sales products.

Separation - Manual or machine separation of large rocks from the coal.

Longwall panel - This is one of several production locations in the mine.
Face - The area from which the coal will be mined.
Undercutting, cutting - A slit is cut which is 15 cm high and 1.2 m deep at the bottom part of the face. This is done in order to create a free surface and available room to blast the coal off the face.
Raw coal - Coal, which has been partially processed. The coal has been passed through the sorting plants or the Bradford roller (a combined coal crusher and rock sorter), but the coal has not been cleaned.

2.4 Geology of Svalbard

Drift

Svalbard hasn't always had the same location as today. And its geographical location continues changing. According to the theory of plate tectonics the continents, or parts of them, are moving slowly (usually a few cm a year); so about 650 MY ago Svalbard which stands on the European Plate was located at 55° S and was drifting in north direction. At 414 MY ago it reached the equator. About 400 MY ago an easterly continental plate collided with westerly one and that event led to forming of Caledonian mountain chain.

Some major horizontal movements took place at the close of the Devonian period, after the Caledonian folding episode. One theory maintains that Spitzbergen is composed of several segments that have drifted for long distances, one moving from an area in northern Canada. After these movements, conditions were quiet until the transition between the Cretaceous and Tertiary when segments of the European Plate began drifting independently of one another. First

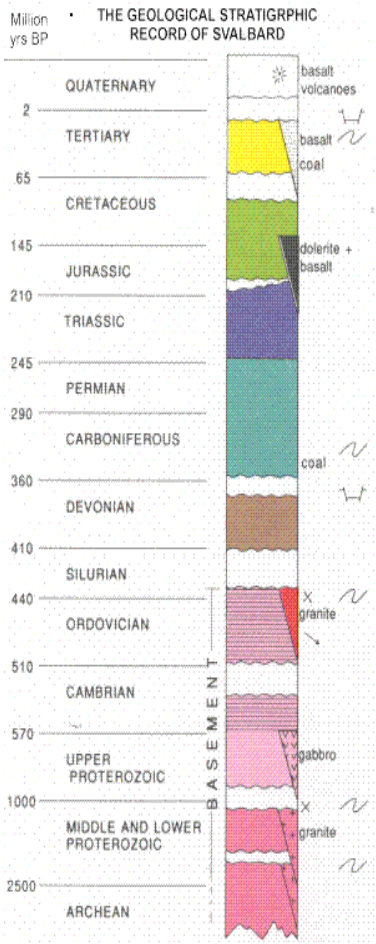


Fig.3 The geological stratigraphic record of Svalbard. Hjelle, A. "Geology of Svalbard". NPI

Norway drifted away from Greenland, forming the Norwegian Sea. In the north, compression and thrusting initially took place resulting in the belt of Tertiary folding and faulting. Later, around mid-Tertiary time, approximately 40 million years ago, a period of north-south rifting was initiated and Svalbard began drifting away from Greenland; the Greenland Sea opened. In response to these huge plate movements in what is now the North Atlantic region, tremendous volumes of lava poured out of fractures to build up the Mid-Atlantic Ridge. Ocean spreading and volcanic activity are still going on today.

Geology fieldwork. Photo K.Tuschling

From Precambrian to Silurian

In this time the Svalbard basement was formed. It consists of igneous and more or less altered (metamorphic) rocks. They are often called the Hecla Hoek series, rocks or formation after the mountain Heclahuken, furthest northeast on Spitzbergen. This basement is older than about 4000 MY. The age of the oldest rocks are difficulty determinated so the oldest rocks have been changed by folding and recrystallisation. But some minerals such as zircon are extremely resistant to external influences, and zircon gives an age of 3.2 billion years (found in northwestern Spitzbergen).

Sample of fossils. Photo H.Kassens

Fossils in detail. Photo H.Kassens

Most basement rocks lay so deep in the crust that they were exposed to high pressures and temperatures and therefore became

particularly strongly metamorphosed. For instance, on northwestern Spitzbergen and the northern part of Nordaustlandet The lowermost beds have been so deep in the crust that high pressures and temperatures transformed sedimentary rocks and volcanics into mica schist, gneiss and migmatite; and here disrupted remnants of marble and amphibolite beds can often also be seen.

New minerals crystallised and some bedrock was wholly or partially melted, and igneous rocks were intruded. Besides the process of metamorphization the basement has undergone several periods of folding. The last large-scale folding and metamorphism took place in the Silurian (the Caledonian Orogeny). When that ended, rivers, glaciers, rain and wind began eroding the mountains that had formed.

The oldest fossils found in Svalbard - stromatolites (fossil algae colonies that grew in shallow water), are associated with beds of limestone or dolostone of proterozoic age.

Silurian and Devonian

Colliding two continental plates: the Canadian-Greenland Plate (Laurentia) and the Fennoscandian Plate, causing large-scale folding and faulting (the Caledonian Orogeny).

All rocks older than late-Silurian are therefore folded and metamorphosed to varying degrees. Investigations of fossil magnetism show that Svalbard was close to the equator just after this folding episode.

At the transition from Silurian to Devonian (end of the main Caledonian Orogeny), northern Spitzbergen began sinking. The Devonian beds formed from the material deriving from the eroding mountains were deposited on the old, planed-off surface of the Caledonian mountain chain from Silurian time. The sediment produced a total thickness of around 8000 m of sandstones, conglomerates and shales. Sedimentary rocks from the very uppermost Devonian are lacking in Svalbard.

The Devonian is called the Age of Fishes, and fossils of primitive fish, the first-known vertebrates, and primitive plants have been found in Svalbard. The first terrestrial plants evolved at this time. The Devonian beds, which often consist of characteristic red sandstones, correspond to what is called the Old Red Sandstone in the British Isles. The colour implies periods of dry, desert-like climate, with rare, but heavy, showers which could give rise to rivers and lakes.

Where Devonian beds are absent, either because they were never deposited or because they have been removed by erosion, the Carboniferous rocks lie directly on the basement.

Carboniferous and Permian

The total thickness of Carboniferous-Permian deposits rarely exceeds 1500 m, but at the head of Isfjorden it reaches 2900 m in places.

The first part of the Carboniferous: Svalbard was still a relatively flat land area with lakes, lagoons and alluvial plains. The Svalbard Plate gradually drifted to wetter, more tropical areas. The lower part also has coal seams containing plant fossils, showing that there must have been a fairly luxuriant swamp vegetation in Svalbard at that time. They were mostly spore plants (cryptogams) that resembled horsetails, ferns and other plants found today, but these were much larger. This was the Age of Amphibians, animals which thrived both in water and on land. Beside amphibians the fish, insects and scorpions were also numerous.

So in this time was the formation of coal, particularly in central parts of Spitzbergen. The lowermost, coal-rich, Carboniferous beds are lacking in western Spitzbergen, where sandstone and conglomerate dominate.

In the middle of the Carboniferous, and the Upper Carboniferous mostly consists of marine deposits (the level sea began to rise). Repeated faulting along north-south lines produced differences in height and there was an alternation between deposition on land and in shallow marine areas. Typical rocks are breccias, limestone and dolostone containing fossil bivalves (mussels) and gastropods (snails), and beds of gypsum or anhydrite.

The climate: from wet to desert-like (drifted from a damp, sub-tropical area to a dry, temperate one further north). Usual animal were Brachiopods (lamp-shells), sometimes from the shells of dead individuals a pure shellbanks were formed on the sea floor. Many limestone beds were formed from such shellbanks.

The Lower Permian beds greatly resemble the uppermost Carboniferous. The Permian indicate the Brucebyen Beds (named after Brucebyen, Billefjorden). These are characteristic, dark-coloured limestones situated about 10m above the Carboniferous-Permian boundary.

The land uplifting, and then rising level sea in the Middle Permian. So forming shallow-water marine deposits in areas that periodically became dry. There was an abundance of various shellfish.

Upper Permian: flint layers formed from fossiliferous. They largely consist of siliceous sponges, brachiopods and bryozoans (moss-animals), and are resistant to erosion.

Triassic, Jurassic and Cretaceous

During the Mesozoic, the Svalbard region drifted from about 45°N to 60°N, and the climate was largely temperate and damp. Marine and terrestrial deposition alternated. Many forms of life died out, including trilobites. The rocks from this period are mostly shales, siltstones and sandstones, seldom limestones. The land surface had largely been levelled and conditions were more stable than in Carboniferous and Permian times. The maximum thickness of strata is around 2600 m. There was a rich animal and plant life during the Mesozoic, reptiles being particularly abundant, and this period is often called the Age of Reptiles.

Triassic and Lower Jurassic

The Lower and Middle Triassic rocks in Svalbard: grey and black shales with beds of sandstone. The Middle Triassic shales often contain phosphatic layers rich in hydrocarbons - oil shale. The Upper Triassic: thin coal seams. Common fossils in the Triassic deposits in Svalbard are bivalves and ammonites. In the Lower Triassic was found fossils of vertebrates, such as reptiles. In the Upper Triassic and Lower Jurassic: some reddish, iron-rich, claystone beds.

Jurassic and lowermost Cretaceous

In this period, most of what is now Svalbard was covered by sea.

The sedimentary rocks consist mostly of dark marine shales, often rich in fossil squids (ammonites and belemnites) and bivalves. Remains of Plesiosaurs, swan-necked marine reptiles which lived in the Jurassic seas, have been found near Isfjorden and on the east coast.

The end of the Jurassic and at the beginning of the Cretaceous, the stable conditions in Svalbard were interrupted by a period of disturbance with volcanic activity and faulting.

Cretaceous

The Svalbard area was situated further south than today - about 130 million years ago it was between 50° and 60° N.

The land uplifting; extensive alluvial plains, and the bedrock formed consists sandstone in which many terrestrial plant fossils. In this period, which may be called the age of the large reptiles.

The upper part of the Lower Cretaceous sees an alternation of marine and terrestrial deposits - siltstone, shale and sandstone. Important fossils are bivalves, squids, snails and fragments of tree

trunks. In the latter part of the Cretaceous: erosion. The uplift of the "Svalbard block" was greatest in the north, and most of the succession is lacking there. Several animal groups among them ammonites, belemnites and dinosaurs died out.

Tertiary

At the transition between the Cretaceous and Tertiary periods: portions of the Euro-American Continental Plate started to move relative to one another, the land uplifting, erosion increased and a distinct break in the succession developed. The Lower Tertiary beds: sandstones. Luxuriant vegetation resulted in several coal seams and plant fossils. Many Tertiary plants greatly resemble present-day ones.

This Central Tertiary Basin formed in the southern part of Spitzbergen, from Isfjorden to Storfjorden. At the beginning of the Tertiary, Svalbard was situated at about the same northerly latitude as southern Norway is today. Despite the rich plant life, several deposits indicate that fjord and shore ice occurred locally along the coasts in winter.

The end of the Tertiary: the crustal movements triggered off volcanic activity in northern Spitzbergen.

Late in Tertiary time, Svalbard had attained more or less its present shape and size, but the sculpturing of the landscape with its mountains, valleys and fjords was largely carried out during the Quaternary.

Quaternary

During the Quaternary Svalbard has been covered by a vast ice sheet. Prior to the last Ice Age which called Weichsel, glaciers in Svalbard were not significantly larger than today, whereas towards its end the ice probably covered large parts of the Barents Sea and also stretched far out across the shelf west of Spitzbergen. The glacial erosion has removed most deposits and other traces of former ice ages. The land was depressed by the ice, most where this was thickest. When the climate became milder and the ice melted, the land rose again. Kong Karls Land, for instance, has risen approximately 130 m relative to the sea during the last 10,000 years, since the ice sheet disappeared. Since it takes time to recover from the pressure of the ice, the land is still rising slightly, even though the heavy ice cap disappeared long ago.

The ice sheet left its marks on the Svalbard landscape. After the ice sheet melted, the glaciation has continued on a smaller scale, and local glaciers, together with rivers, have gradually removed some of the

moraines and glaciofluvial deposits formed by the ice sheet, and deposited new ones. Terminal and lateral moraines in Svalbard frequently have an ice core that partially melts in summer.

The climate after the Ice Age was periodically warmer than now and conditions today are in many ways like in the end of the last Ice Age, 8-10,000 years ago.

Svalbard fossils

FOSSIL	PERIOD	DESCRIPTION
AMMONITES	particularly numerous in the Mesozoic, especially in the Jurassic and Cretaceous	an extinct group of squids with spirally shaped shells
BELEMNITES	common in the Mesozoic, especially in the Jurassic and Cretaceous.	an extinct group of squids with bullet-like shells
TR1LOBITES	particularly numerous in Cambrian and Ordovician times, and became extinct in the Permian.	many species are good index fossils
BRACH1OPODS (lamp-shells)	common in the Palaeozoic and Mesozoic, but many species are also living today	sedentary marine animals with shells like those of bivalves
GRAPTOL1TES	from Cambrian to Carboniferous	colonial animals living in the sea important index fossils
FORAM1NIFERA	from the Cambrian to the present day	
STROMATOLITES	in Svalbard found in some Upper Proterozoic dolomitic beds	
DINOSAURS	from Triassic to Cretaceous times	large terrestrial reptiles fossilised footprints of the herbivorous Iguanodon and fossils
BRYOZOANS (moss-animals)	from the Ordovician onwards common fossils in Permian beds in Svalbard	colony-forming marine animals
PRIMITIVE FISH	common in the Devonian	lacked jaws and teeth, a cartilaginous skeleton with the head and part of the body covered by bony plates.

Longyearbyen

Mostly our excursions took place near Longyearbyen (Adventdalen, Bjorndalen). In these places mountains consist of Lower Cretaceous deposits overlain by Lower Tertiary.

Near Longyearbyen, a Tertiary conglomerate lies directly upon the eroded Lower Cretaceous. The conglomerate is less than 1 m thick. The overlying Tertiary sequence largely consist of sandstones and siltstones, with some shales. The most important coal seams are found in the lower part of the Tertiary succession. Plant fossils are found at several horizonts in the succession, including fossilized trees. Well-preserved leaves and other parts of plant occur in the uppermost tertiary strata.

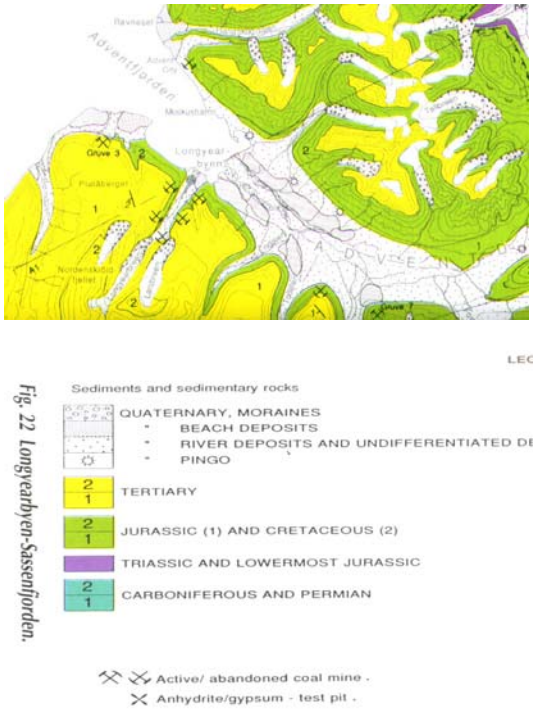


Fig. 22 Longyearbyen-Sassenfjorden.

Several examples picked during our excursions are showed below.

2.5 Ice Conditions, Glaciers and Permafrost

Glaciology

Svalbard is located at the climatic boundary of the polar front. Any shift in the position of this boundary would have a noticeable effect on the archipelago's glaciers and ice caps.

Svalbard's glaciers and ice caps are particularly interesting. They are large enough to hold approximately 0.4 meters of sea-level equivalent which, if released to the ocean, would have a dramatic impact on low-lying coastal regions of the world, yet they are small enough that they react quite rapidly to changes in climate.

Ice caps on Svalbard. Photo H.Kassens

The mass balance of glaciers in Svalbard is sensitive to atmospheric and marine circulation changes. The interaction of calving glacier fronts with the marine environment is of particular interest. Surging glaciers are common in Svalbard, making this region unique in the high Arctic, and providing opportunities to understand the dynamics of glaciers and ice sheets in the region and to assess critical thresholds that may play an important role in ice movement.

Glacier near Longyearbyen. Photo H.Kassens

Permafrost

Permafrost underlies approximately 25% of the world's land surface, and it is widespread in high-latitude and altitude regions.

The specific effects of macro-scale climate change on permafrost are not likely to be simple, because of the complex nature of the interactions between climate, microclimate, surface, and ground

thermal conditions. Nevertheless, theoretical considerations suggest that relatively rapid changes may occur in the active-layer depth, defined as the depth of summer thaw, and in the distribution of warm permafrost near its southern limit.

Ground patterns formed by cyclic freezing, on Longyear plateau. Photo H.Kassens

Rest on the top. Photo H.Kassens

Changes in the depth of the active layer would have diverse and far-reaching implications, because all hydrologic, geomorphic, pedologic, chemical, and biological processes are sharply focused in this surface layer. In addition, increased active layer depth may influence regions far beyond permafrost areas, exacerbating greenhouse warming by releasing carbon dioxide and methane currently stored in permafrost to the atmosphere.

Svalbard is underlain by permafrost that penetrates down to 200 to 300 meters below soil surface, depending on the thermal forcing at the surface. During the summer the soil surface thaws, permitting plant and animal life in the upper 1 to 2 meters of the soil. The winter is commonly punctuated by warm intervals during which moist, warm Atlantic air sweeps over the area. This air mass produces heavy snow, slush, and rain as it converges with cold arctic air.

In the presence of a changing climate, therefore, permafrost can play at least three important roles:

1) as a recorder of shallow ground temperature, stored in deep permafrost,
2) as an agent of environmental changes that affects landscapes and land-ocean and land-atmosphere interactions as well as ecological and human communities, and
3) as an amplifier of further climate change.

2.6 Flora and Fauna of Svalbard

Polar biological systems are simple and relatively undisturbed. They are strongly influenced and controlled by extreme seasonal changes in day length and harsh climates with extensive annual variations.

The climatically most favourable part of Svalbard is central Spitzbergen. The climate is appreciably more severe to the south, east and north. In summer, drift ice is chiefly found south, east and north.

Because of low mean temperatures the subsoil is permanently frozen often to depth ranging from 150 to 300 m below the surface.

Some 165 species of plants have been identified on Svalbard, many of them flowering in fantastic displays of colour. The largest bird colony in the North Atlantic is on Svalbard, with hundreds of thousands of pairs nesting in most years. The most common species are fulmars, auks, and kittiwakes. Reindeer and arctic fox are often seen around the houses. More than 2,000 polar bears roam the archipelago.

Most of the vegetation is found from the tidal zone up to 200 m above sea level. There are no trees, except for the tree-like growths such as the stunted arctic willow (*Salix polaris*) and in a few places also the dwarf beach (*Betula nana*). The vegetation is most densely

Sparse tundra vegetation on Svalbard. Photo POMOR

developed at the foot of bird cliffs or other nesting sites for birds.

In many places the vegetation has a mosaic character. Consequently, over a few square meters it may alternate between tussocks with vegetation typical of mounds and ridges, and a wetland vegetation of grasses and mosses in depressions.

The vegetation is protected in certain areas. The plant life of Svalbard extends right to the margin of the icy wastes of the Arctic. Regenerative and reproductive processes in plants move extremely slowly so far north. The picking and collecting plants therefore has much more risk of a plant becoming extinct is greater.

The low growth of the tundra vegetation provides little cover in which the birds can hide. The larger birds place the nests in the open. They usually have feathers with camouflage coloration.

The growing season of plants is short in the arctic. The production of plants in the summer provides the nutritional basis for plant-eaters such as Svalbard reindeers, geese and ptarmigans (wild polar chicken). These species are usually found concentrated in areas where there is a good availability of nutritious plants.

The most active periods for mammals and birds in Svalbard are the three summer months. The climate is then mild enough to allow reproduction. The snow-free summer period is short. By

September it again begins to snow, but the fjords do not usually freeze over until winter.

In the arctic marine environment, sea ice is a major abiotic control factor on vertebrate communities. Several species of whales, seals, and sea birds are near the top of short food chains which are ultimately based on the seasonal production of epontic algae. Zooplankton and arctic cod are important intermediate links.

The seasonal sea ice acts as a substrate important to cod for the growth of algae (food for their zooplankton prey) and as a complex three-dimensional habitat offering refugia from predation.

Understanding the impacts of changing ice cover on vertebrate populations will require long-term studies of the dynamics of systems based on epontic algal production.

The basis for the high production in the sea is the capacity of phytoplankton (algal plankton) to build organic material using the sun's energy. It is very important part of the food chains forming. The interaction between life in the sea and life on land is very evident in an area such as Svalbard. This is well demonstrated under the bird-cliffs where the vegetation is much greener than in the surrounding areas.

There are 164 different species of birds (only 30 regularly breed) but the mammal fauna is relatively poor. There are only two true land mammals in Svalbard; the Svalbard

reindeer and the arctic fox. The polar bear is considered a marine mammal since it spends almost its entire life in the drifting sea-ice.

The little arctic fox is extremely well adapted to the harsh arctic weather conditions. The insulating qualities of its fur are the highest measured for any animal. In its search for food and mates the arctic fox can cover great distances, both on land and on the drifting sea ice, where it commonly follows the polar bear hoping for scraps.

The two most common seal species are the ringed seal (*Phoca hispida*) and the bearded seal (*Erignathus barbatus*).

Bearded seal rests on an ice floe (Erignathus barbatus). Photo NPI

Along the West Coast of Spitzbergen is also found a small colony consisting of the world's northernmost representatives of harbour seal (*Phoca vitulina*). The bearded seal and walrus feed mainly on benthic animals.

The musk ox *Ovibos moschatus* was also introduced over 50 years ago, but is now probably extinct because it couldn't compete with reindeer for food.

Svalbard reindeer (*Rangifer tarandus platyrhynchus*) was observed in groups of 2-7 individuals very often during our excursions.

The size of male can be about 160 cm and 90 kg weight. The coat is brown on the back, light on the belly, in the summer often with a clear stripe on the belly. During the winter the coat pales to a light grey, almost yellow-white. The thick coat contributes to the short-legged appearance.

The Svalbard reindeer is a distinct subspecies with shorter legs and more body fat. It has little fear of people. Photo H.Kassens

The bucks (males) develop heavy antlers during the period April-July. They lose them early in winter. The doe (female) begin to grow antlers in June and they are usually retained for a whole year.

The reindeer spends the winter on mountain ridges and in other areas such as mountain plateaus with a thin covering of snow where it is easy to get to the vegetation underneath. In summer they move to the more nutrient tundra areas.

Doe gestates for about 7 months and gives birth to the single calf in June. The calf suckles for about 3 months and grows rapidly to prepare the winter surviving.

The Svalbard reindeer has a varied diet and will eat almost all types of plants. Where reindeers occurs in Svalbard, their grazing and trampling are important ecological factors. The impact is particularly great on plant communities, which have little snow cover in winter. Lichen flora and associated vascular plants suffer from that. Trampling both by people and reindeer readily leads to wind erosion of the soil in dry localities and erosion by water and frost.

The reindeer have a very well developed ability to use the body's own reserves (fat) when access to grazing is poor in winter.

Polar Bear

Creatures of the Glacial Epoch, polar bear come recently in the nature. Polar bear is one of the largest carnivores. Weight of largest was 1000 kg. It was killed on Alaska. The largest polar bear on Svalbard was 700 kg. But in early spring female can weight only 200 kg in autumn on 100-200 kg more. The length of adult male is about 2,5 m.

At the top of the food chain, polar bears are susceptible to organic pollutants. Photo Kit Kovacs and Christian Lydersen, NPI.

The area of Polar bear is Arctic and also Canadian sub-arctic, Eastern Greenland, Alaska, Novaja Zemlja, Svalbard.

Polar bear traditionally feed on seal blubber, young walruses, salmon, whales and sometimes, small amount of claps and grass. Polar bear kill rain deer very seldom, but any happens occurs. Polar bear needs about one seal per week - more than 50 seals per year. Polar bear is capable to feel any molecules on distance more than 20 kilometers. He has long neck - it helps him to search the seal in the breeding holes. Then polar bear searched and killed the seal; hi eat only skin and blubber. Adult polar bear usually do not eat seals red meat. Polar foxes consume red meat. They usually follow polar bear.

Polar bear is very good insulated. Hi has thick layer of fat. His fur is glass-like, and the skin under the fur is black. The fur isolated the body and the black skin accumulated the heat. So, the heat lost is about

zero. The body temperature of polar bear is like humans. But the temperature about zero are not good to polar bear and at summer hi usually have to migrate north or live close to the water.

Polar bear is capable to stay erect to take the best look on the prey or on another polar bear. Adult male may be 6 feet in the shoulders and about 12 feet high. Polar bear can walk over the ice, so thin, to bold up a man. Crossing rubbery new ice a bear will reduce the impact of his weight still further by lying on his stomach and spreading his legs. Grooming in snow is important to health and comfort.

Polar bears children are called cubs, polar bears older than 2 years but younger 4-5 years are called sub-adults. Mating period began at 4-5 years. In late autumn female make liar in snow, usually on steep slope. In this liar she will stay all winter. Cubs are borne at the end of year. Usually there are twins and their weight is 0.5 kg of each. Arctic environment is so harsh that every second or third cubs died. The female can have only 6 cubs during all her life. Female appears from the liar in early spring in March - April, after the half-year long non-feeding period. The cubs weight in this time is about 10 kg. The family stays together 2 years.

Polar bear is closely associated with sea ice, especially with pack ice, close to the open water - there are a lot of leads, where seals are abundant. During the winter part of the bear's population drift southwards with the pack ice into the Barents Sea and Svalbard fjords. In spring then the ice breaks most of bears migrate out.

After the Second World War 300 polar bears were killed each year on Svalbard. In Norway, polar bears are completely protected and have been since 1973. Biologists estimate their population at 22,000 to 27,000 bears, of which around 15,000 are in Canada. On the glacial Svalbard islands, their population has rebounded from a low of about 1,000 to roughly 2,000 bears. Scientists are worried, however, about the effects of pollution on the bears. PCB levels in the polar bears of Norway and western Russia are two-and-a-half to seventeen times higher than those in North American populations.

The list of species observed during our expedition:

Birds
Fulmar *Fulmarus glacialis* (Ny-Ålesund)
Barnacle goose *Branta leucopsis* (Longyearbyen near airport)

Arctic tern and chick, Ny-Ålesund, Svalbard. Photo by Dee Boersma.

Ringed plover *Charadrius hiaticula* (Longyearbyen near airport)
Great skua *Stercorarius skua* (Longyearbyen, Bjorndalen)
Gulls (everywhere)
Arctic tern *Sterna paradisaea*
(everywhere)

Animals
Svalbard reindeer *Rangifer tarandus platyrhynchus*
(Longyearbyen, Bjorndalen)
Arctic fox *Alopex lagopus*
(Ny-Ålesund, Longyearbyen)
Bearded seal *Erignathus barbatus*
(Ny-Ålesund- Blomstrandbreen)

Arctic fox. Photo Kit Kovacs and Christian Lydersen, NPI.

Plants
Saxifrage *Saxifraga spp.*
Polar Willow *Salix polaris*
White Arctic Bell-heather *Cassiope tetragona*
Mountain sorrel *Oxyria digyna*
Arctic Cottongrass *Eriophorum scheuchzeri*
Drooping saxifrage *Saxifraga cernua*
Tufted saxifrage *Saxifraga cespitosa*
Svalbard Poppy *Papaver dahlianum*
Alpine Bistort *Polygonum viviparum*
Stitchworts *Stellaria sp.*

Tundra buttercup *Ranunculus hyperboreus*
Small dwarf bush Mountain Avens *Dryas punctata*
Meadow-grasses *Poa sp.*

Oxyria digyna

Lichens, mushrooms
Sea algae
2 species of *Laminaria*
Fucus
Phyto- and zooplankton
Tintinnoid sp.
Nitzshia closterina
Silicoflagellate sp.
Chaetoceros sp.
Dinoflagellate sp.

2.7 Protection of the Environment of Svalbard

Favourable climatic conditions, political policies, very good accessibility and a highly developed infrastructure make Svalbard a very attractive platform for Arctic research. The volume of international research has increased in Svalbard over the last decade.

Through the «Svalbard Treaty» of 9 February 1920, Norway has «full and absolute sovereignty» over Svalbard. However, the Treaty directs Norway to give nationals of all contracting parties equal liberty of access and the right to pursue maritime, industrial, mining and commercial activities. The Treaty instructs Norway to take suitable measures to ensure the preservation of the natural environment of Svalbard and its territorial waters.

The Svalbard Environmental Protection Act was passed by the Norwegian General Assembly (Storting) on 12 June 2001 and entered into force 1 July 2002, concurrent with alterations of the regulations dealing with protected areas, flora and fauna, cultural heritage, land use planning, waste, contamination and traffic. The Act allows for environmentally sound settlement, research and commercial activities.

The scope of the Act includes the entire land area of Svalbard and its waters reaching out to the territorial limit, which currently extends to four nautical miles from the shore. The Act consists of following chapters:

Chapter 1: Introductory provisions

Chapter 2: Duty of care and principles regarding the exercise of authority

Chapter 3: Protected areas

Chapter 4: Flora and fauna

Chapter 5: The cultural heritage

Chapter 6: Land-use planning areas

Chapter 7: Activities that have an environmental impact

Chapter 8: Inspection and control measures

Chapter 9: Enforcement and sanctions

Chapter 10: Final provisions

The Act draws up a framework that is complemented by a number of additional regulations. The following regulations apply:

Regulations on offroad motor traffic and use of aircraft for tourism purposes

Regulations of harvesting

Regulations of protected areas

Regulations regarding toxins, waste and fees for draining and waste

Regulations concerning impact studies and boundaries of areas of planned use Camping regulations and rules about keeping dogs on leash.

Some applications:

Fauna. The entire fauna of Svalbard is protected. It is not allowed to hunt, catch, injure or kill animals except as allowed by the Act or other current regulations.

Flora of Svalbard must not be harmed or removed. However, it is allowed to collect plants for scientific purposes. Introducing new species or removing endemic plants is not permitted unless special dispensation has been received.

Polar bears. It is not allowed to lure, pursue or actively look for polar bears unless granted a special permit. Anyone doing field activities in Svalbard must learn about the experience of others and to familiarise himself with recommended behaviour and the use of equipment necessary to prevent confrontations with polar bears.

Cultural heritage. Svalbard's historical relics are protected and taken care of as part of the cultural heritage of the heritage. Relics from 1945 or dating further back are automatically protected, including a security zone of 100 metres around them .It is prohibited to set up camp, light a fire or leave traces of activity within the security zone. Also it is not allowed to harm, dig out, move, remove or in any other manner damage a cultural relic.

Aircraft. It is not allowed to fly closer than one nautical mile to large, known concentrations of birds and mammals without a special permit.

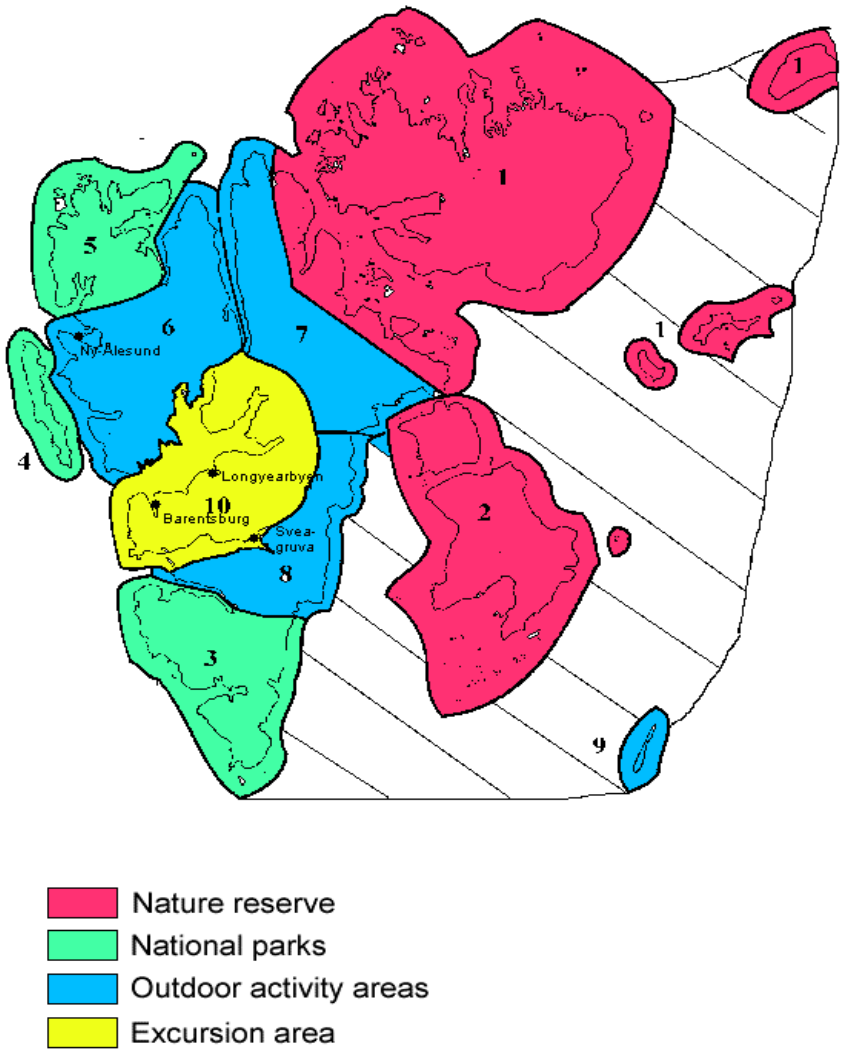
Traffic All motorised traffic in the terrain is initially forbidden. However, there are exemptions regarding use of snowmobiles on snow-covered ground in certain areas. Dispensations from the prohibition will be given when special reasons exist and the activity has been approved by the Governor.

Hunting. Recreational hunting and fishing is allowed to a limited extent. Personal hunting and fishing permits can be applied for according to the rules from the harvesting regulations.

Tourism. Travel outside the central areas of Spitzbergen must be notified on a specific form to the Governor. There are also obligations to notify the Governor about base camps, and special rules for the establishment of such camps under the camping regulations.

Pollutants. It is not allowed to leave behind, dump or discharge waste, pollutants or other contaminants in Svalbard's nature. All installations, instruments, used for research are regarded as waste after the project has been concluded and must be removed.

Protected areas



Large parts of Svalbard – more than law protects half of the total area – either as national park or as nature reserve. Influence by man has been relatively limited in all of these areas. The Norwegian authorities wish to preserve Svalbard's distinct qualities and natural beauty so that future generations also will be able to experience the unique polar nature and the cultural remains from human activity in earlier times.

The protected areas are particularly valuable natural asset for future generations. A mandatory notification rule applies for travel to all of Svalbard's protected areas. The law requires you to notify the

Governor's office if you are planning to visit the protected areas and are not part of a tour organised by a registered tour operator.

The national parks are open to basic, non-motorized outdoor recreation. In special cases, for example for scientific purposes, the Governor can allow limited use of snowmobiles, airplanes, or helicopters.

North-West Spitzbergen National Park (3,650 km) covers the north-western corner of Spitzbergen and some smaller islands. There are numerous and large seabird colonies in this park. Among the mammals we can find Svalbard reindeer, arctic fox, denning areas for polar bears, and resting places for walrus. This national park also contains several historic sites of very high cultural value, including Smeerenburg and Virgohamna. Several whaling stations and burial grounds from the 1600s have been excavated at these sites through extensive archaeological programs. We also find the remains of several grand-scheme expeditions, for example Salomon August Andrйe's attempt at reaching the North Pole with a hydrogen-gas balloon in 1897. A range of finds from Virgohamna, along with unique photographic documentation found on the island Kvitшya 30 years after the expedition disappeared, tell the story of how these daredevil polar explorers ended their lives up here.

Due to heavy traffic, there will be special restrictions on visiting Virgohamna starting from the summer of year 2000. Please contact the Governor's office, your travel agent, or your tour operator for more details.

Forlandet National Park (640 km) is the smallest of the three national parks. The landscapes of this long, thin island vary between long beach flats, high mountain peaks, and many smaller glaciers. Here we find important nesting grounds for eider duck (*Somateria mollissima*) and geese. The island abuts the most northerly arm of the Gulf Stream, which creates a relatively mild oceanic climate. The world's northernmost population of harbour seal (Phoca vitulina) is found on Forlandet.

South-Spitzbergen National Park (5,300 km) comprises the southernmost parts of Spitzbergen. Glaciers or permanent snow and ice covers about 65% of the area. The national park contains a variety of

Whale skeleton in Geshamna. Photo K.Dahle, NPI

arctic landscapes. The avian fauna is particularly rich, with several large seabird colonies and important nesting grounds for eider duck (*Somateria mollissima*) and barnacle geese (*Branta leucopsis*). In Hornsund, in the south-western part of the park, there is a Polish research station, which is manned year-round.

The Nature Reserves have a somewhat higher level of protection than the national parks. Here, all traffic (including non-motorized) can be forbidden if this is found to be necessary to protect the plants, animals, or natural character of the land. The nature reserves were established to protect large tracts of undisturbed arctic wilderness, where all the natural, ecological processes can proceed as much as possible unhindered by man. Such areas have a special intrinsic value, and they are of great importance to science as natural reference areas when studies are being made of more impacted areas. This is the main reason why regulations are tighter in the nature reserves than in the national parks.

Moffen Nature Reserve (8 km)**,** a little gravel island within North-West Spitzbergen National Park, was established in 1983 after traffic had increased substantially in the area. Moffen is a very important haul-out (resting) area for walrus, and an important nesting site for birds. The protected area comprises the island itself and an area stretching 300 meters out to sea from the island of from any of the rocks surrounding it..

From May 15th through September 15th all traffic - including non-motorized – is strictly prohibited within or over the protected zone.

This ban applies both to traffic on land, at sea, and in the air lower than 500 meters altitude.

North-East Svalbard Nature Reserve (19,030 km) is the largest of Svalbard's protected areas. The reserve includes the islands Kvitшya, Kong Karls Land, and Nordaustlandet. The small archipelago Kong Karls Land is the most important denning and cub-rearing area for polar bears in this part of the Arctic. For this reason a strict year-round ban on traffic is imposed. The ban applies to all traffic on the islands themselves, out to sea a distance of 500 metres from the nearest point on land or adjacent rocky outcroppings, and in the air up to 500 meters altitude above this area.

South-East Svalbard Nature Reserve (6,450 km) covers the two large islands Edgeшya and Barentsшya, and several smaller nearby islands and islets. A large population of Svalbard reindeer lives within this reserve. Polar bears are also common, especially during the winter. The walrus population is on the increase in these waters. In addition we find important nesting grounds for several bird species within the reserve boundaries.

Bird Reserves

There are 15 special bird reserves in Svalbard, all of which are found along the west coast of Spitzbergen. Almost all of these reserves are small islands or islets. The main function of the bird reserves is to preserve the most important nesting sites for eider ducks (*Somateria mollissima*), barnacle geese (*Branta leucopsis*) and Brent geese (*Branta bernicla*). These species seek out nesting sites on small islands and islets that are not surrounded by ice during the summer. Since such ice-free islands are not easily accessible for one of the main predators of eggs and chicks: the arctic fox. There are not many such ice-free islands in Svalbard. The concentration of nesting birds can therefore be quite high in the bird reserves.

During this time it is strictly forbidden to enter the bird reserves. This applies both to the use of motorized vehicles, non-motorized boats or other vehicles, or even just visiting on foot. The reserves include the sea out to 300 meters from land or from rocks that are a part of the protected island.

Plant protection areas

Two plant protection areas were established as early as 1932 in Svalbard. One is in the inner part of the large fjord Isfjorden (north and east of Dicksenfjorden and Sassenfjorden), and the other is in an area between the valleys Colesdalen and Adventdalen. Within these areas it

is not permitted to pick plants.

A third plant protection area was established in 1984 at Ossian Sars in the inner part of the bay Kongsfjorden, where we also find the settlement Ny-Ålesund. The function of this plant protection area is to protect its lush vegetation, which includes several rare plant species. It is permitted to visit this area, but due caution is to be shown so as not to damage the vegetation. It is not permitted to pitch tents in the Ossian Sars plant protection area.

Protected cultural monuments and heritage sites

According to the Svalbard Environmental Protection Act, all traces of human activity from 1945 or earlier are protected cultural remains.

This applies to all types of buildings and remains of buildings, construction sites, hunting and trapping installations, bones and remains from animals at old slaughtering sites, graves, crosses and inscriptions, as well as all loose artefacts, such as remains of traps, bone, tools, ammunition and cartridge cases, shards of ceramics or glass, fragments of chain or cable, piles of iron shavings, shoe soles, barrel hoops and parts of stoves. Loose artefacts are often by-products of the intended activity at a site, or just plain waste, but they are not without value. More than the remains of the buildings themselves, such artefacts tell the story of everyday life at the site. They reveal what people did, what chores they carried out, what methods they used, where they came from, and how life in general was in Svalbard at that particular time.

Destruction or removal of both fixed and loose cultural remains is punishable by law. Heavy fines have been imposed upon individuals and tour operators who have broken these rules in recent years. The protection includes a security zone stretching 100 meters from the outer edge of the protected item or site. Within this zone it is not permitted to set up a camp, burn fires or in other ways to leave behind unnecessary signs of having been there.

3
Practice work in Ny-Ålesund

3.1 Overview

Ny-Ålesund is situated in the Northwest of Spitzbergen, close to Kongsfjord. It is the northern persistent settlement in the World. Today it is a centre for international polar research. The population varies between 30 overwinterers and at times more than 150 in the summer when a lot of guests are there.

The Ny-Ålesund research facilities are unique at these latitudes (79^0 N) and offer complementary and alternative research opportunities. A large number of Norwegian as well as international programs and projects use Ny-Ålesund as a base, making it a truly scientific village with minimal influence from industry, tourism, and traffic, yet with housing and lab facilities for most purposes.

Ny-Ålesund as seen from across the Kongsfjorden, or King's Fjord. Photo Kit Kovacs and Christian Lydersen, NPI.

Ny-Ålesund was founded in 1917 by coal miners from the Norwegian town Alesund.

The site became worldwide famous in the years 1926 and 1928, when two airship North Pole expeditions started from here.

The age of coal mining persisted until 1963. After some accidents, the coal mining was terminated, and for some years there were nearly no activities in Ny-Ålesund. Only few staff was present for some maintenance work.

In 1966, the settlement was revitalised by a telemetry station of ESRO.

In 1970, the research station of the Norwegian Polar Institute began its operation. Since this time, the location became an important place for research activities of many nations and in a lot of disciplines.

Ny-Ålesund was going on a steady improvement of its facilities. In the last years, a new quay was built, the airfield was expanded, new houses for research, accommodation and other purposes (e.g. a small shop) were built, and the infrastructure was enhanced and improved.

Kings Bay A/S (KB), formerly a coal company and now a stateowned corporation under the Ministry of Commerce and Energy, owns Ny-Ålesund and is responsible for maintaining and developing the town's infrastructure, generating power, supplying water, running the Nordpolhotellet (North Pole Hotel) with full room and board, maintaining buildings, and constructing laboratories and field stations for Norwegian and foreign institutions. KB also is responsible for local air traffic services as well as harbor services. KB employs between 25 and 35 people in Ny-Ålesund.

Ny-Ålesund from Zeppelin station. Photo R. Neuber, AWI

Research activities in Ny-Ålesund are coordinated through the Ny-Ålesund Science Managers Committee (NySMAC). It includes representatives from institutions that have permanent research activities and larger facilities in Ny-Ålesund. NySMAC provides advice to NPI and KB regarding the coordination and administration of research activities, as well as building and maintaining infrastructure in the Ny-Ålesund area. The institutions represented in NySMAC have access to information on all aspects of research activities in Ny-Ålesund and function as focal points for this information in their respective home countries.

The Ny-Ålesund International Research and Monitoring Facility includes research stations for Norwegian, German, British, Italian, French, and Japanese institutions, as well as the European Union's Large Scale Facility (LSF).

Permanent research stations are operated by:

- Norwegian Polar Institute (Norsk Polarinstitutt, Norway);
- Norwegian Governmental Mapping Authority (Statens Kartverk, Norway);
- Alfred- Wegener-Institut (AWI, Germany);
- Chinese (since September 2003).

Further, there are part-time operated research stations:

- Natural Environmental Research Council (NERC);
- United Kingdom National Institute for Polar Research (NIPR);
- Japan Consiglio;
- Nazionale delle Ricerche (CNR), Italy;
- France Polar Institute.

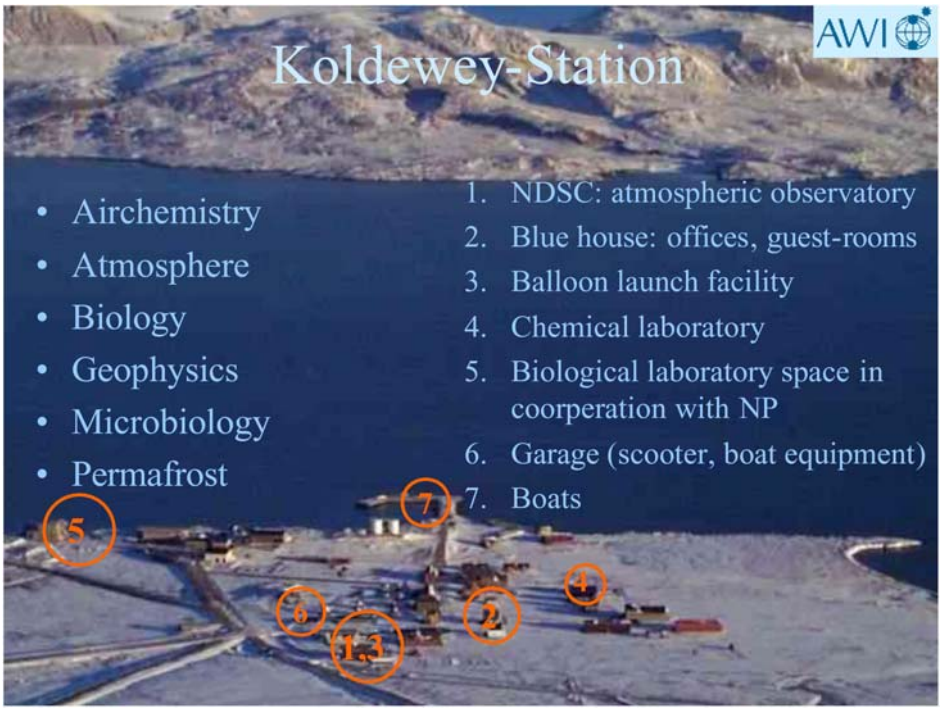
France also operates a field camp station some kilometres away from Ny-Ålesund for some weeks each summer.

3.2 Koldewey station

We were received by German station, which was called Koldewey. This name was given in honour of Carl Koldewey, leader of the first German North Pole Expedition. He cruised the waters before Spitzbergen as far back as 1868.

The German Alfred Wegener Institute for Polar and Marine Research (AWI) established year-round activity in Ny-Ålesund in 1991. In 1994, a specially designed and newly constructed observatory was inaugurated as part of the Koldewey Station. The station comprises several buildings. All are owned by the Kings Bay AS (former KBKC)

and are rented by AWI. The core of the station is the Blue House. Built in 1917, it belongs to the oldest houses of Ny-Ålesund.



Facilities of Koldewey-Station. Photo by R. Neuber, AWI

Today, the Blue House has various functions for the AWI research station and is in use both for working and living purposes. Here is the administrative office for the station leader, as well as some work places and the living rooms for up to eight guests.

The Koldewey Station is run as a comprehensive base for a large spectrum of polar research with special emphasis on atmospheric sciences. The bulk of observations are dedicated to the global Network for Detection of Stratospheric Change (NDSC) and concentrates on the arctic stratosphere, in particular the ozone layer.

Blue House. Photo POMOR

Long-term measurements and campaigns on atmospheric research are part of cooperation with many institutes and international scientific bodies. The station is a member in several international networks, among them the World Meteorological Organisation (WMO). Other research activities are ongoing in terrestrial and marine biology, geology, and chemistry.

3.3 NDSC Programme

The atmosphere has undergone considerable change due to human influences over the last 30 years. Perhaps the most spectacular is the formation of the Antarctic ozone hole. Ozone depletion in the stratosphere, with harmful consequences for life, alerted the world community to the fragility of the atmospheric environment. This resulted in the signing of the Montreal Protocol and its Amendments and Adjustments to restrict the release of ozone-destroying industrial chemicals into the atmosphere. Evidence of ongoing atmospheric change has led to important questions for policymakers and the world community. How will stratospheric ozone respond as the abundance of ozone-destroying chemicals decreases? How will atmospheric composition respond to and influence climate? In this regard, comprehensive yet focused atmospheric research has never been more vital.

Vision from NDSC Observatory. Photo POMOR

Having a scientific presentation. Photo POMOR

The International Network for the Detection of Stratospheric Change (NDSC) was formed to provide a consistent, standardised set of long-term measurements of atmospheric trace gases, particles, and physical parameters via a suite of globally distributed sites.

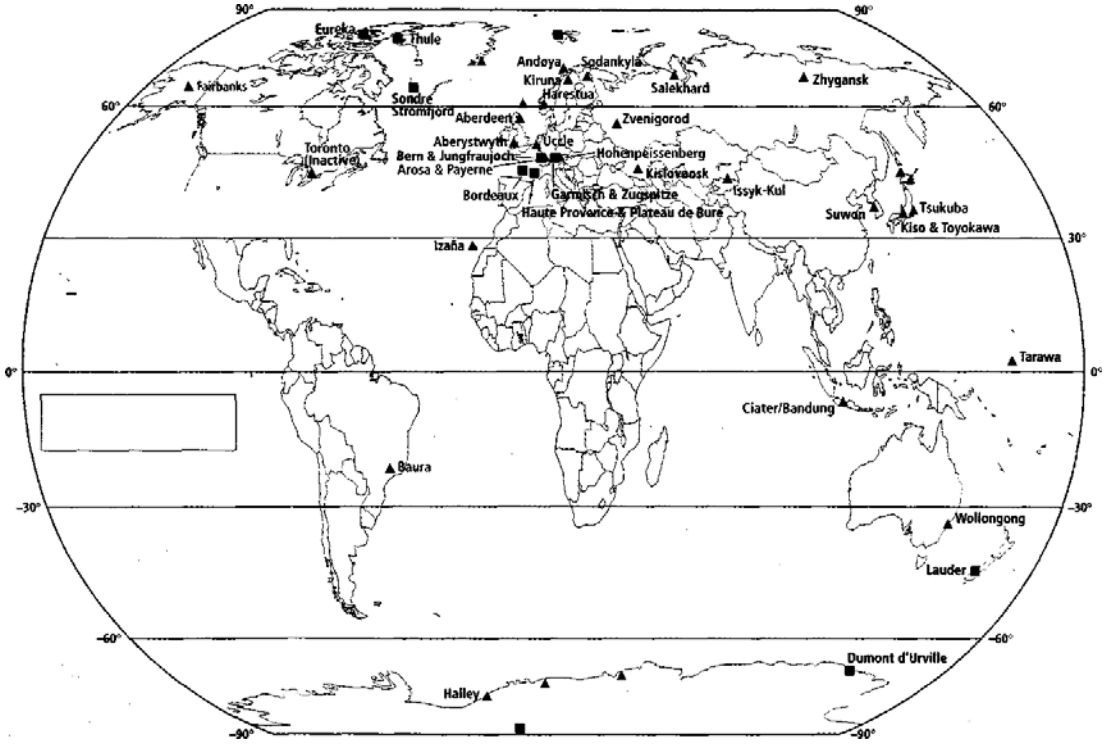
In Ny-Ålesund this stratospheric monitoring program is conducting Alfred Wegener Institute with together the University of Bremen and the Norwegian Institute for Air Research.

Sins 1992 the Network for the Detection of Stratospheric Change started to investigate of stratospheric ozone depletion at the poles and midlatitudes, and documented the increase and levelling-off of ozone-depleting chemicals in the atmosphere and the continued growth of greenhouse gases.

It supplies key long-term observation data essential for improving our understanding of physical processes in the atmosphere.

The NDSC is supported by national and international agencies.

Obtained the meteorological and aerological data are sent on a regular basis to the World Meteorological Organisation (WMO).



There is the map of the global Network.
■ *NDSC Primary Sites*
▲ *NDSC Complementary Sites*

3.4 Methods and Instrumentation

Due to the site characteristics and thanks to the logistic support of the Ny-Ålesund community, this place was choosen to carry out the meteorological observations of wind, pressure, temperature, radiation, ozone as well as instrumentation monitoring and measurements.

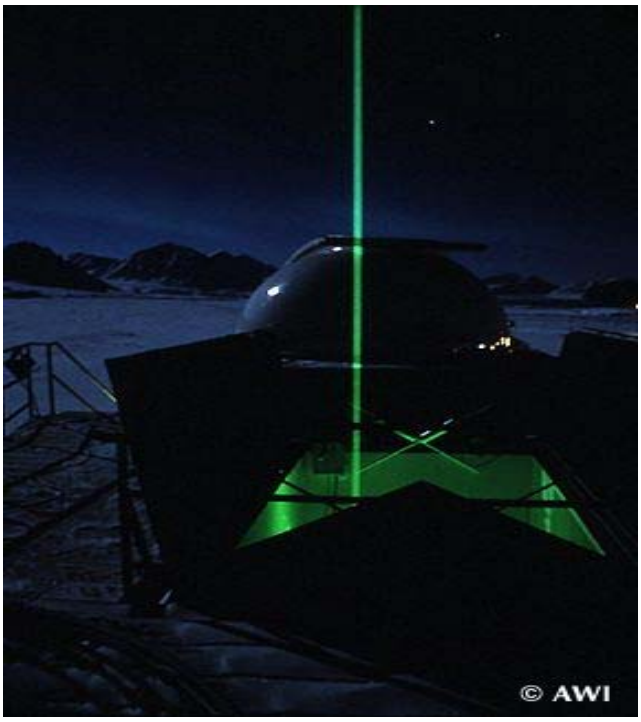
The training have been made and organized by Koldewey-Station staff.

The instrumentation employed in the practice included: LIDAR, FTIR, RAM, Ozone balloon.

LIDAR

The Ozone LIDAR uses two laser wavelengths to measure the ozone in the atmosphere.

The basic idea is simple: a pulse of laser lights is emitted into the night sky (this condition is necessary only for ozone measuring in stratosphere because troposphere ozone can be measured also during the day) and the amount of light scattered back from the atmosphere is measured versus time. Knowing the speed of light, the time is converted into height.



Laser beam leaving telescope room

The amount of light returned from each height is proportional to the atmospheric density. In case Ozone LIDAR the concentration of ozone is determined from the strength of the reflected signal.

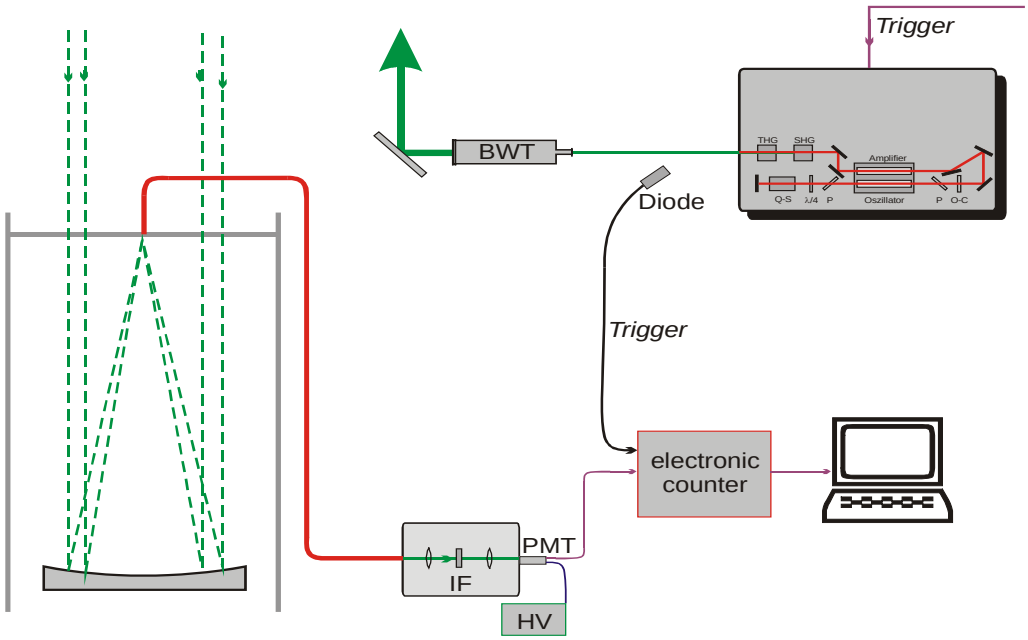


Fig.4 LIDAR system: schematic drawing. R.Neuber, AWI

In the during work of Ozone LIDAR we obtain the vertical ozone profiles with a range of approximately of 7 to 50 km.

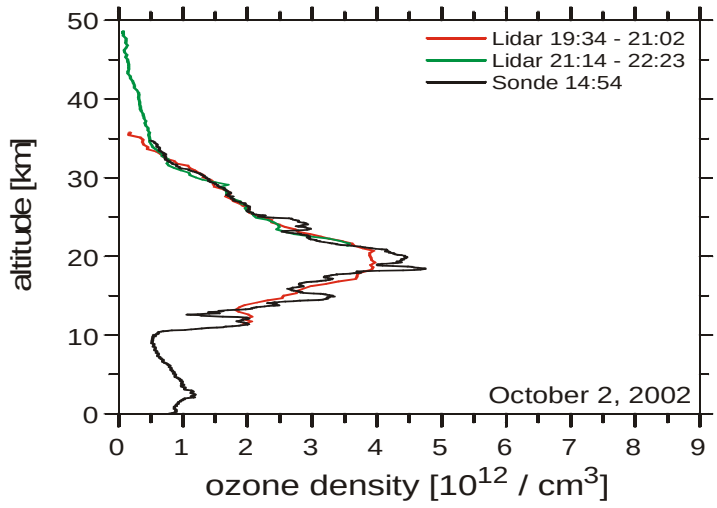


Fig.5 Vertical ozone profiles. R.Neuber, AWI

Measurements are usually made under cloud-free conditions, and they have the advantage of high sensitivity and good altitude resolution.

RAM (Radiometer for atmospheric measurements)

This device was used and built by the Institute of Environmental Physics at the University of Bremen. It is used for the detection of the atmospheric trace gases in the altitude range o15-60 km (stratosphere and lower mesosphere). The receiver currently detects ozone and chlorine monoxide (ClO). ClO - key compound responsible for catalytic ozone destruction.

The shape of the spectral line depends on the pressure at the different altitudes of the atmosphere. Broad lines - from high-pressure regions at lower altitudes. By mathematics operations we can derive the vertical distribution of a trace gas from its measured spectrum.

RAM has an altitude resolution about 10 km, and time resolution about 2 hours. Microwave remote sensing has several advantages:

1) Very strong signals - they are independent of clouds, so RAM works at any weather.
2) Method due to thermal radiation is independent of sunlight and moonlight.
3) Microwave remote sensing is currently the only method, which yields info on ClO.
4) Works 24 hours.

Appearance of RAM. R.Neuber, AWI

Instrumental description:

RAM is similar to radioreceiver but it works at much higher frequencies. The current set-up is used for detection of ozone at 142 GHz and ClO - at 204 GHz. The handle these high frequencies the atmospheric signal is combined with a local oscillatory signal. The output signal can be handled with off-the shelf microwave components. Since the incoming radiation is extremely weak (10-12 Watt) the signal must be amplified by a factor of 100 billions. The receiver signal is

separated into its different frequency channels by an acoustic-optical spectrometer. The whole instruments are operating automatically. Data are stored on Digital Audio Tape (DAT) and are analysed at Bremen.

At the mm-wave range the noise of the detector normally reduces the sensitivity of the receiver and therefore it is necessary to cool the detector to a temperature of -261°C.

At Koldewey Station RAM was operated during 1992/93 for ozone measurements and 1993/94 - for ozone and ClO measurements. During these measurements ozone variations 1 ppm could be observed within few hours.

FTIR (Fourier Transform Infrared Spectrometer)

FTIR is used for determining columns of trace gases in the troposphere and stratosphere. Trace gases in the troposphere are H2O (vapor), CH4, CO, NH3 etc. and in the stratosphere ozone, HCl, HF, NO2 , HNO3 , ClONO2 ,CFCs and so on. The main principle is absorption spectroscopy using the sun or moon as light sources and emission spectroscopy. Here we can observe the absorption of the molecules from vibrational-rotational transitions.

Advantages of the FTIR are the possibility to measure the presence and concentration of many trace gases simultaneously both in the stratosphere and troposphere and very high resolution of the device.

Disadvantages are the requiring the sun (or full moon during the polar night) as sources of infrared radiation. This measurements take 10 minutes (sun) and 3 hours (moon).

FTIR. R.Neuber, AWI

OZONESONDE: using, configuration, measuring principles

Koldewey station, Ny-Ålesund operates a balloon sounding system of VAISALA, Finnland for the determination of temperature, pressure, humidity, wind and ozone profiles up to 38 km altitude. The launching of the balloon with radiosonde is made every day in the interval from 11.45 to 12.15 UTC (the preparation operations take about 15 minutes). The launching of the balloon with ozonesonde and radiosonde is made every Wednesday at the same time (the preparation and calibration operations take about an hour).

The balloon borne insitu sensors of VAISALA, Finnland is composed of:

- a radiosonde, which includes sensors for temperature, pressure, humidity, a receiver for GPS wind measurements and the radio emitter for online data transfer during the sounding.
- a chemical ozone sensor for ozone concentration measurements
- an electronic data interface between radiosonde and ozone sensor
- a parachute for combined radiosonde/ozone sensor payloads.
- a rubber balloon, filled with He gas

Radiosondes can operate independently, while the ozone sensor needs the radiosonde for data transfer to the ground station.

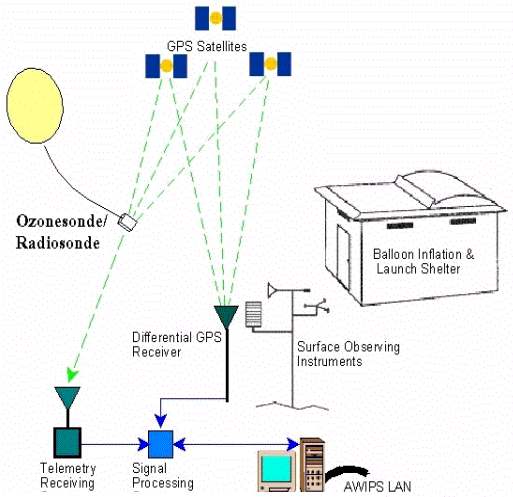


Fig6. Radio/ Ozonesonde replacement system

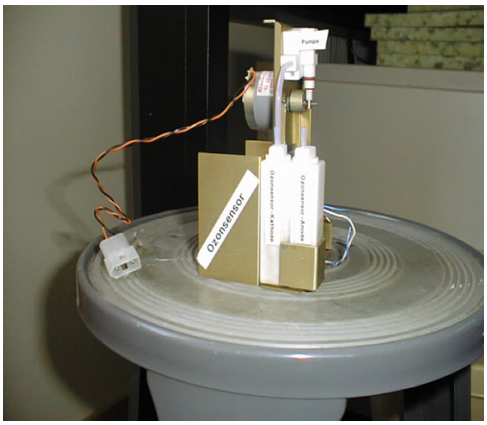


Fig. 7. Ozonesonde sensor

The ozonesondes are used to measure the ozone concentration throughout the atmosphere. That means radiosonde is connected to an ozone sensor. This is done with the help of the interface which then transmit ozone sensor data to the sonde and via the antenna to the ground station. The whole system for the work of ozonesonde includes also balloon inflation and launch shelter, surface observing system for calibration, receiving and processing systems and computer (fig.6).

The ozonesonde as a device has advantages and disadvantages. The *positive* sides of ozonesonde using are:

- Continuos estimating of ozone throughout atmosphere
- Most accurate measurements and heights accuracy
- The detection limit – 1 57 2 parts per billion
- Providing vertical ozone profiles up to 30 km
- All-weather measuring.

The *negative* sides are:

- Inability to measure the ozone distribution above 30 km (<3hPa) due to the balloon
- Non-permanent using because only 10% of instruments are found and can be used for a second time
- Cost of one ozonesonde is about 600 € and radiosonde about 160 €.

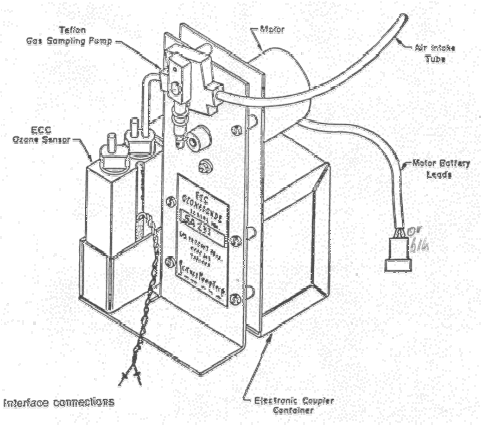


Fig. 8. Electrochemical concentration cell sensor

The ozonesonde is quite fragile and is therefore set into a big styrofoam box. An extra battery is needed to give energy to the motor of the pump which pump an air from the outside. This air is then pumped into the sensor – first into the cathode and from there to anode (fig.7). These two cells are filled with two differently concentrated potassium iodide solutions. Through chemical reactions that are taking place, there is a current from which we get in ozone partial pressure. Now the ozone concentration can be calculated in Dobson units.

Pumping up the balloon. Photo POMOR

Two platinum electrodes are housed in anode and cathode chambers. The chambers are electrically interconnected by an ion bridge (fig. 8). For a principle drawing of the ECC sensor see fig.8.

As soon as air containing ozone flows into the cathode solution a chemical reaction starts. If switch S is closed the current can be measured. R is the load resistance of the circuit.

Sensor solution requirements are very exacting. The sensor solution should be prepared using reagent-grade chemicals and double

or triple distilled water.

(1) Cathode solution (500 mi distilled water): 10g KI 25 g KBr 1.25 g $NaH_2PO_4*H_20$; 5 g $Na_2HPO_4*12H_20$

(2) Anode solution: 125 g KI added to 100 ml of cathode solution. This solution is saturated and all crystals are not dissolved.

The solution is pH-buffered (pH=7) because the stochiometry of the reaction is highly pH dependent. The pH-value of above solutions is not exactly 7 in all conditions due to differences in their total water content. The chemical reaction in sensor chambers is affected by the sensor dimensions, air bubbling the total liquid volume of the sensor, and by the temperature of the sensor solution. These factors introduce some basic error and variance.

Sensor reactions

Because platinum electrodes are chemically inert, they do not take part in chemical reactions. They are used only to carry ions between cells. Electrochemical reactions take place in the boundary layers of the electrodes. As soon as air containing O_3 molecules is bubbled through the cathode liquid the following total reaction will take place:

(1) $2KI + 0_3 + H20 \rightarrow 2KOH + I_2 + O_2$

I_2 is formed and I_2 concentration of the solution starts to increase. If the external circuit is closed (switch, fig. 9) the reaction (1) is followed by reactions (2) and (3):

In the cathode chamber

(2) $I_2 + 2e^- \rightarrow 2I^-$

In the anode chamber

(3) $3I^- \rightarrow I_3^- + 2e^-$

Total cell reaction is redox reaction:

(4) $3I^- + I_2 \rightarrow I_3^- + 2I^-$

Reactions in cathode and anode chambers are different because of different I concentrations and the reactions direction is as shown by arrows because of the driving internal electromotive force (emf).

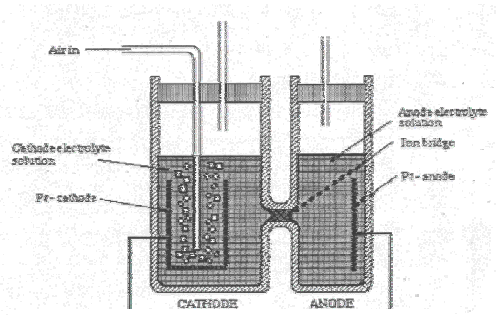


Fig. 9. Ozone sensor principle

Activity of the chemical compounds is approximately equal to concentration. If an $_{O3}$ molecule comes into the cathode chamber, reaction (1) takes place and iodine concentrations are changed and the emf is not zero. Reactions (2) and (3) happen and I- and 13- concentrations change. Reactions (2) and (3) are the rate determining stages, because ions must find their ways to electrode surfaces. The conclusion is that: every O_3 molecule causes a current of two electrons. This current can be measured and the data from ozonesonde through radiosonde is transmitted to the computer.

4
Case Study

4.1 UNIS

The *University Centre on Svalbard (UNIS*) is a state-owned limited company. Norway's four mainland universities are represented on the board. The objectives of UNIS are to provide university level education in Arctic studies, to carry out high quality research, and to contribute to the development of Svalbard as an international research platform. The archipelago's geographical location in the High Arctic makes it an ideal venue for laboratory work and also for the acquisition and analysis of specialist data.

University Centre on Svalbard. Photo www.unis.no

UNIS is located in Longyearbyen. It came into operation in autumn 1993, when its first 23 students started courses in Arctic Geology and Arctic Geophysics. The Arctic Biology program was introduced in 1994 and the Arctic Technology program in 1996.

The courses in these four lines of study are intended to complement the teaching given by the mainland universities, and they are integrated in standard courses of study that lead to examinations and degrees at intermediate, advanced and doctoral level. All the UNIS

courses are based on the exceptional location of Svalbard and the pre-eminence of this region as an "Arctic laboratory".

The study programs have an international profile and about half of all students come from abroad. All courses are given in English. Tuition fees are not required.

Department of Arctic Biology

Offers education and performs research in Arctic Biology and Ecology in marine and terrestrial environments. It includes the next courses:

- Terrestrial Arctic Biology
- Marine Arctic Biology
- Arctic Environmental Management
- Polar Ecology and Population Biology
- Light, Climate and Primary Production in the Arctic
- Arctic Microbiology
- Arctic Freshwater Ecology
- Marine zooplankton and sympagic fauna of Svalbard.

Department of Arctic Geology

The geology of Svalbard comprises a well-exposed succession of Palaeozoic metamorphic rocks succeeded by sedimentary rocks right up to the present-day Quaternary deposits. The courses offered here:

- The Geology of Svalbard
- Arctic Marine Geology
- The Physical Geography of Svalbard
- Marine Geological and Geophysical Studies: Data Acquisition and Interpretation
- Seismic Exploration
- Arctic terrestrial and marine Quaternary stratigraphy
- Sequence Stratigraphy: A tool for basin analysis
- Glacial and Periglacial processes
- Glaciology
- The Quaternary climate history of the Arctic
- Sedimentary facies analysis
- Quaternary climate records and climate models.

The Arctic Geophysics Department

Specialises in four fields of teaching and research: Oceanography, Meteorology, and Middle and Upper Polar Atmospherics. The courses:

- Space activity and Remote sensing
- Remote Sensing
- The middle polar atmosphere
- Air – ice – sea interaction
- Processes in snow and ice
- Polar Meteorology
- Polar Oceanography
- The upper polar atmosphere
- Radar diagnostics of space plasma
- Remote sensing and advanced spectroscopy.

The Arctic Technology Department

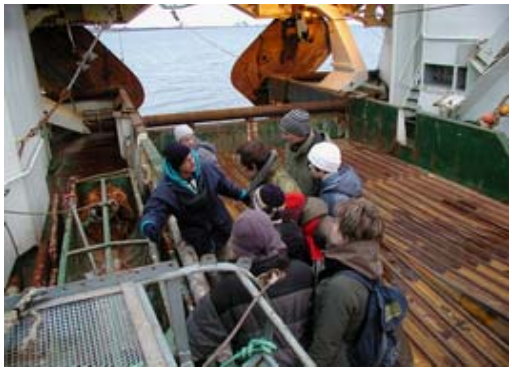
Arctic technology involves upgrading of well-proven technology to suit the Arctic climate or in some cases development of completely different and specialized technology tailored to the harsh environment. The special courses are offered here:

- Frozen ground engineering for arctic infrastructure
- Arctic water resources
- Pollution in the Arctic
- Thermo-mechanical properties of materials
- Arctic offshore engineering
- Fate and modelling of pollutants in the Arctic
- Radioactivity in the Arctic environment
- Thermo-mechanics of ice and snow, and loads on structures.

UNIS programs rely heavily on the natural properties of Svalbard as a high-latitude research laboratory and on the extensive research infrastructure in and around Longyearbyen. UNIS researchers work in collaboration with Norwegian and foreign research institutions and are actively involved in a large number of joint research projects.

UNIS will form the core of the Svalbard Science Centre (SSC), an international Arctic centre of expertise in research and education, which will also incorporate other professional and scientific institutions on the islands. The new 9000 sq.m main building (including existing facilities of 3200 sq.m) is due for completion in 2005. The greatly expanded volume will facilitate continuing strong development of education and research at UNIS.

4.2 Research Vessel "Jan Mayen"



The R/V "Jan Mayen" is a multipurpose vessel, designed for fishery and marine biological, geological and oceanographic surveys in open and ice covered waters (1-2 m drift ice). The ranges of investigations include fish resource assessments, hydrographic and trawl surveys, geological bottom sediment sampling and acoustic registrations of the sediment layers below the seabed. R/V "Jan Mayen" is equipped with modern instruments, and has especially designed features for improved acoustic surveying and bottom sediment sampling. This ship was built as a trawler in 1988, and redesigned as a research vessel in 1992. The ship holds accommodation for 30 persons (21 single/double cabins), and is used for different kinds of research activities:

- Shrimp/fish stock assessments
- Geological investigations (bottom cores, echo sounding, acoustic surveying)
- Plankton surveys
- Fishing gear trials and underwater surveys
- Marine mammal surveys
- International work shops
- Naval training courses

5
Integrating Research & Education

Increased German - Russian collaboration in polar and marine research will promote common interests in the scientific issues related to the arctic regions and will improve the availability of resources and infrastructure.

Different factors have contributed to this situation, for example, the impact of the large European research and development programs, globalization of international research involving new regions, and a general decline in mobility of young researchers. Consequently, a long tradition of cooperation has been weakened. In this context, new opportunities are needed for collaboration in arctic research between institutions and individuals in the two countries.

POMOR initiative is intended to revitalize such cooperation in a broad range of scientific fields in the Arctic.

The participants agreed that the training of young scientists and specifically student participation should be a central component of German-Russian collaboration in arctic research activities on Svalbard. Opportunities for integrating research and science education identified by the students are summarised:

- Contact among Russian and German students early in their careers will build productive relationships among future polar researchers;
- POMOR students opportunities to do supervised fieldwork (atmosphere observatory, ship and ice station based) under actual arctic conditions;
- Foster greater awareness of the POMOR program among science institutions, research projects doing polar and marine investigations, and
- Support Russian/German post-graduate, faculty exchanges and fellowship.

Student participation in research also provides opportunities for long-term observations, important in calibrating paleoclimatic records and in improving our understanding of arctic processes. In this regard, the existing baseline of meteorological and other environmental observations in the Svalbard region (especially in Ny-Ålesund) is extremely valuable.

Special efforts should be made to develop units for use at Koldewey-Station, establish scientific links with UNIS, Norsk Polar Institute and other arctic educational facilities that would use information from the entire region.

Annexes

A: Programme of «2003 Svalbard Science Odyssey» September, 3 - 21

Wednesday, 03 September

17.50	Departure, train from St. Petersburg to Murmansk.

Thursday, 04 September

22.00	Arrival, Bus-transport to «Moryak» Hotel

Friday, 05 September

13.40	Departure, flight AN-24 to Tromsoe
13.40	Arrival, Taxi to Norsk Polar Institute (NPI)
13.40 – 16.00	Guided tour in NPI, Polaria – museum.
16.00	Taxi to Hotel «Sidspissen», free time

Saturday, 06 September

08.00 – 08.30	Breakfast in Hotel «Sidspissen»
12.00 – 13.00	Bus to Hotel «Nord»
13.30 – 22.00	City excursions, cable car on mountain.
18.00 – 19.00	Supper in Hotel «Nord»

Sunday, 07 September

08.00 – 08.30	Breakfast in Hotel «Nord»
09.00 – 20.00	Visiting of Polar Museum, Defence Museum and Botanical Garden.
23.30	Departure, Boeing 737 to Longyearbyen.

Monday, 08 September

01.10	Arrival, accommodation at NPI Hotel
09.00 – 10.00	Breakfast
10.00 – 11.00	Safety instructions,
11.00 – 14.00	Visiting to downtown recognizing the infrastructure
15.30	Departure of the 1Working Group (1a,1b) to Ny-Ålesund (please see annex B)

Tuesday, 09 September

09.00 – 10.00	Breakfast
10.00 – 14.00	Excursion to the Bjorndallen
14.00 – 15.00	Lunch
15.00 – 18.00	Visiting the Library in Longyearbyen

Wednesday, 10 September

09.00 – 10.00	Breakfast
10.00 – 18.00	Exploring of specific topics

Thursday, 11 September

09.00 – 10.00	Breakfast
13.30 – 15.30	Arrival of 1WG and parallel departure of 2WG (2a,2b) in Ny-Ålesund
14.00 – 15.00	Lunch
15.30 – 19.00	Geology fieldwork on Longyear plateau. Collecting fossils

Friday, 12 September

09.00 – 10.00	Breakfast
10.00 – 14.00	Glaciology fieldwork on Longyear plateau.
14.00 – 15.00	Lunch

15.00 – 18.00	Ny-Ålesund presentation by 1WG. Preparing the topics

Saturday, 13 September

09.00 – 10.00	Breakfast
10.00 – 14.00	Excursion to Svalsat ground station on the Longyear plateau. Collecting of phyto/zooplankton species
14.00 – 15.00	Lunch
15.00 – 18.00	Training on study phyto/zooplankton biology.

Sunday, 14 September

09.00 – 10.00	Breakfast
10.00 – 14.00	Excursion on seacoast, Svalbard Museum
14.00 – 15.00	Lunch
15.00 – 18.00	Presentation of science topics

Monday, 15 September

09.00 – 10.00	Breakfast
10.00 – 14.00	Excursion to the EISCAT Svalbard Radar
13.30 – 15.30	Arrival of 2WG and parallel departure of 3WG (3a,3b) in Ny-Ålesund
14.00 – 15.00	Lunch
15.00 – 18.00	Presentation of science topics

Tuesday, 16 September

07.30 – 08.30	Breakfast
09.00 – 13.00	Visit to UNIS
13.00 – 14.00	Lunch
14.00 – 16.30	Excursion on Glacier

17.00 – 19.00 Exploring Research Vessel "Jan Mayen".

Wednesday, 17 September

09.00 – 10.00 Breakfast

10.00 – 14.00 Excursion to Bjorndallen valley

14.00 – 15.00 Lunch

17.00 – 21.00 Party with UNIS students. Shoping

Thursday, 18 September

09.00 – 10.00 Breakfast

10.00 – 12.00 Listening of reports. Concluding remarks.

13.00 Arrival of the 3WG from Ny-Ålesund

14.55 Departure, flight to Tromsoe

16.30 Arrival, bus to Hotel "Nord".

Friday, 19 September

08.00 – 09.00 Breakfast in Hotel "Nord"

14.20 Departure, flight to Murmansk

16.00 Arrival in Murmansk

01.00 Departure, train to St.Petersburg

Sunday, 21 September

04.50 Arrival in St.Petersburg

B: POMOR visit to Koldewey-station

September 8 – September 18, 2003

Working Groups:
1a Dauren Khassanov, Roman Smagin
1b Maria Surovtseva, Julia Strelchenko
2a Natalia Vaganova, Anastasia Moshkina
2b Anna Nikulina, Anna Korobkina
3a Irina Ivanova, Irina Polovodova
3b Olga Preobrazhenskaya, Darya Vasilyeva

SHEDULE:

Date/Time	Group 1a	Group 1b
Monday, September 8		
16:00	Arrival in Ny-Ålesund, check-in	
17:30	Safety instructions	
18:30	Free time	
Tuesday, September 9		
9:00	Short tour through the station, start at the Blue House	
10:00	Meteorological programs at the station	NDSC measurements
12.30	Radiosonde	
13:15-16:30	Meteorological measurements and typical data	LIDAR
16:30-20:00	Preparation of a presentation	
Wednesday, September 10		
9:00	Ozone sondic preparation	
12:30-13:15	Ozone sonde starting up	
13:15-15:00	RAM, FTIR, LIDAR	Meteorological measurements and typical data
15:00-20:00	Tour to the Bloomstrandbreen	
21:00	Presentation “Ozone dynamic in Ny-Ålesund”	
Thursday, September 11		
10:45	Departure from Ny-Ålesund	

Date/Time	Group 2a	Group 2b
Thursday, September 11		
10:45	Arrival in Ny-Ålesund, check-in	
12:30	Safety instructions	
14:00	Short tour through the station, start at the Observatorium	
15:00	Free time	
Friday, September 12-Sutarday, 13		
10:00	Ozone sondic preparation	
12:30-13:15	Ozone sonde starting up	
13:15-16:30	Meteorological measurements and typical data	**LIDAR, RAM, FTIR**
18:00 (12.09.03)-12:00 (13.09.03)	Tour of the glacier Bloomstrandbreen with spending night in London, Bloomstrandhalvoya	
Saturday, September 13		
13:30	Meteorological programs at the station	NDSC measurements
15:30-17:00	FTIR-measurements and principles of work	
20:00	Preparation of a presentation	
22:00	Party	
Sunday, September 14		
10:00-12:00	Preparation of a presentation	
14:00-15:00	Visiting of the Zeppelin Station for Air Monitoring and Research (Norway)	Preparation of a presentation
Monday, September 15		
13:00	Making presentation “Ozone sonde”	
16:00	Departure from Ny-Ålesund	

Date/Time	Group 3a	Group 3b
Monday, September15		
16:00	**Arrival in Ny-Ålesund, check-in**	
17:30	Safety instructions Short tour through the station, start at the Blue House, acquaintance with the staff of the station	
18:30	Free time	
Tuesday, September 16		
10:00	Meteorological measureme 71 typical data	LIDAR, FTIR
12.30	Radiosonde	
13:15-16:30	RAM, FAR	
16:30-18:00	Preparation of the presentation	
19:00 (16.09.03)-11.00 (17.09.03)	Observal excursion with staying in Utah	
Wednesday, September 17		
11:00:00	Ozone sondic preparation	
12:30-13:15	Ozone sonde starting up	
13:15-15:00	RAM, FTIR, LIDAR	Meteorological measurements and typical data
15:00-19:00	Preparation of the presentation	
19:00	Presentation “The comparison of different devices for meteorological measurements”	
Thursday, September 11		
10:45	Departure from Ny-Ålesund	

References

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